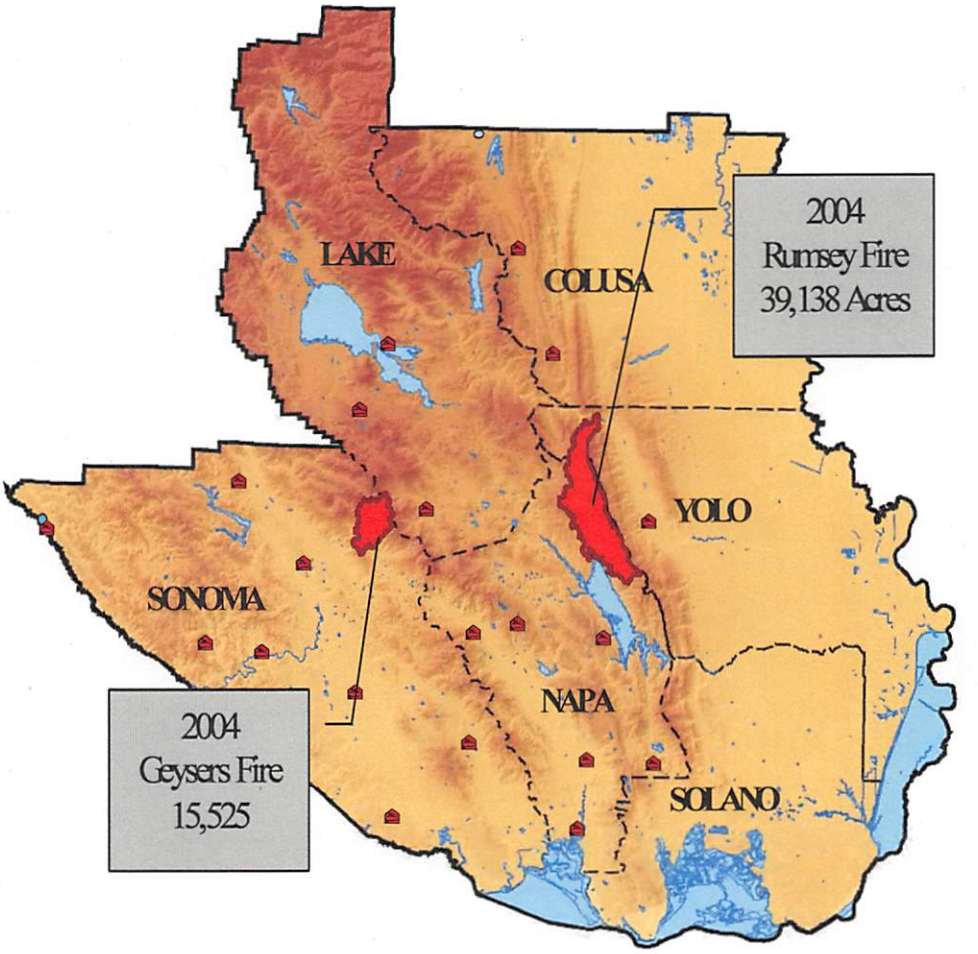
EXHIBIT 11

California Department of Forestry and Fire Protection

SONOMA – LAKE – NAPA UNIT

FIRE MANAGEMENT PLAN

2005



"Mitigating Wildfire Loss through Community Level Pre-Fire Planning"

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I. COMMUNITY WILDFIRE PROTECTION PLAN CONTENT AGREEMENT

The following entities have participated in the evolution of the Sonoma-Lake-Napa Unit (LNU) Fire Management Plan, and presumably agree to its' content:

- Ernie Loveless, Chief, LNU and Napa County Fire Department

Napa County

- Kate Dargan, Fire Marshal, Napa County Fire Department
- Neal O'Haire, Emergency Services Manager, County of Napa
- Napa FIREWISE
- Mt. Veeder Fire Safe Council
- Berryessa Estates Homeowners Association
- Circle Oaks Homeowners Association

Sonoma County

- Sonoma County Department of Emergency Services
- Fire Safe Sonoma
- West Sonoma Fire Safe Council
- Fort Ross Volunteer Fire Company
- Fitch Mountain Homeowners Association
- Fountaingrove Open Space Maintenance Association
- The Sea Ranch Association

Lake County

- South Lake County Fire Safe Council
- Hidden Valley Lake Homeowners Association

II. EXECUTIVE SUMMARY

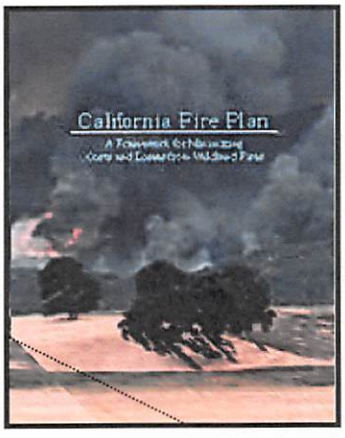
The LNU Fire Management Plan's purpose it to identify the high value, high-risk areas within the six counties, and to provide the planning basis for reducing the damaging effects of wildfire. This is accomplished through a comprehensive approach designed to minimize the costs and losses due to wildfire by a variety of means, including response and evacuation planning, cooperative fuel reduction projects, fire prevention, and education.

Photo 1: Values at Risk near Lake Berryessa

The Plan utilizes stakeholders' input and the best available Geographic Information System (GIS) data along with other data, to analyze fire hazards and assets at risk. These various analyses are then combined into a fire plan assessment. One purpose of this analysis is to identify the high value and high risks where the potential exists for costly and damaging wildfires. These areas can then be prioritized for the development of mitigating treatments designed to reduce future costs and losses. The four basic components of this fire plan assessments are:

- Assets at Risk
- Vegetation Fuel Hazards
- Fire History and Frequency of Severe Fire Weather
- Ignition Workload Assessment and Management Prioritization

The overall goal of these assessments is to reduce the total costs and losses from wildland fire by protecting assets at risk through focused pre-fire management prescriptions and increasing initial attack fire suppression successes. To accomplish this goal, the framework laid out in the 1996 California Fire Plan guides is utilized. This framework forms the basis of an ongoing fire planning process to monitor and assess the Unit's wildland fire environment. It consists of five strategic components[1]:



[1] "California Fire Plan" Executive Summary CDF Sacramento, March 1996.

1. **Wildland Protection Zones.** A key product of this fire plan is the development of enhanced wildlife safety and "Firewise" communities that reduce citizen and firefighter risks from future large wildfires.

2. **Initial Attack Success.** The fire plan attempts to assess the initial attack fire suppression successes and the Department's ability to provide an equal level of protection to lands of similar vegetation type. This measurement is the percentage of fires that are successfully controlled before unacceptable costs are incurred. Knowledge of the level of service will help define the risk to wildfire damage faced by Public and private assets in the wildlands.

3. **Assets Protected.** The fire plan establishes a methodology for defining assets protected and their degree of risk from wildfire. The assets addressed in the plan are citizen and firefighter safety, watersheds and water, timber, wildlife and habitat (including rare and endangered species), unique areas (scenic, cultural, and historic), recreation, range, structures, and air quality. Stakeholders for each of the assets at risk are identified. The assessment will enable the Unit and other fire service managers to set priorities for prefire management project work.

4. **Pre-fire Management.** The plan facilitates development of a wide range of management prescriptions, utilizing every program and tool available to the Department, for protecting assets at risk. These tools include every conceivable combination of fuels reduction, ignition management, fire-safe engineering activities, code development and enforcement, public education, and forest health enhancements to protect Public and private assets.

5. **Fiscal Framework**. The State Board of Forestry and CDF are developing a fiscal framework for assessing and monitoring annual and long-term changes in California's wildland fire protection systems. State, local, and Federal wildland fire protection agencies, along with the private sector, have evolved into an interdependent system of pre-fire management and suppression forces. As a result, any changes related to budgeted levels of service of any of the entities directly affects the others and the overall services delivered to the Public. Monitoring system changes through this fiscal framework will allow the Board and CDF to address public policy issues that maximize the efficiency of local, state, and federal firefighting agencies.

The ongoing implementation of the Unit's Fire Management Plan is expected to enhance the wildland fire protection system in the following ways:

- Identify for local, state, and federal officials and for the Public those areas of concentrated assets and high risk.
- Allow CDF to create a more efficient fire protection system focused on meaningful solutions for identified problem areas.
- Give citizens an opportunity to identify public and private assets to design and carry out projects to protect those assets.
- Identify, before fires start, where cost effective pre-fire management investments can be made to reduce taxpayer costs and citizen losses from wildfire.
- Encourage an integrated intergovernmental approach to reducing costs and losses.
- Enable policy makers and the public to focus on what can be done to reduce future costs and losses from wildfires.
- Integrate elements of the Fire Management Plan into the land use and safety elements of the general plans of each of the Unit's six counties.

III. UNIT OVERVIEW

The Sonoma-Lake-Napa Unit (LNU) is one of twenty-one (21) California Department of Forestry and Fire Protection (CDF) administrative units (Figure 1). The Unit was created in 1996 with the merger of the then Sonoma Ranger Unit, and the Lake-Napa Ranger Unit. It is comprised of the six counties of Sonoma, Lake, Napa, Yolo, Colusa, and Solano (Figure 2). LNU has primary responsibility for more than 2.1 million acres of State Responsibility Area (SRA[2]), and 2.3 million acres of CDF Direct Protection Area (DPA[3]) lands, more than any other unit (Table 1). It has the third largest population living within CDF DPA, and ranks third in the average number of annual fires.

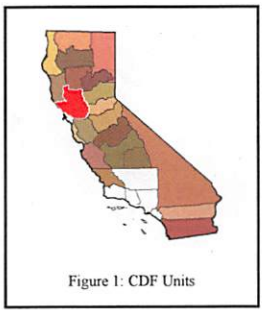


Figure 1: CDF Units

Figure 2: LNU Counties

The Unit is divided into three divisions, and ten field battalions. The boundaries of Sonoma County define the West Division with four battalions. The South Division is composed of Napa and Solano Counties, divided into three battalions. And the North Division, with three battalions consists of the counties of Lake, Colusa, and Yolo. Headquarters, including the Unit's Emergency Command Center (ECC) are located just north of St. Helena in Napa County. Division specific offices are located at two smaller facilities in Santa Rosa in Sonoma County and Middletown in Lake County.

County	SRA Acres	SRA Persons	SRA Houses	DPA Acres	DPA Persons	DPA Houses
Colusa	270,899	708	392	297,360	610	356
Lake	390,084	20,409	11,276	481,598	20,286	11,205
Napa	370,084	17,498	6,741	433,510	17,500	6,742
Solano	93,820	10,751	3,884	96,643	10,751	3,884
Sonoma	793,793	59,030	28,162	817,929	59,041	28,165
Yolo	183,127	1,564	661	209,406	1,564	661
TOTAL:	**2,101,807**	**109,960**	**51,116**	**2,336,446**	**109,752**	**51,013**

Table 1[4]: SRA and DPA Figures per LNU County

[2] The State Board of Forestry and Fire Protection classify areas in which the primary financial responsibility for preventing and suppressing fires is that of the state. These include: lands covered wholly or in part by timber, brush, undergrowth or grass, whether of commercial value or not; lands which protect the soil from erosion, retard run-off of water or accelerated percolation; lands used principally for range or forage purposes; lands not owned by the Federal government; and lands not incorporated. SRA encompasses approximately 31 million acres.

[3] SRA and intermingled federal lands protected by the CDF. Most federal land in state DPA is protected by the CDF under contracts with federal land management agencies.

[4] Data generated by CDF's Fire and Resource Assessment Program (FRAP) using 1999 CDF SRA data, DPA lands, and 2000 Census Block Data.

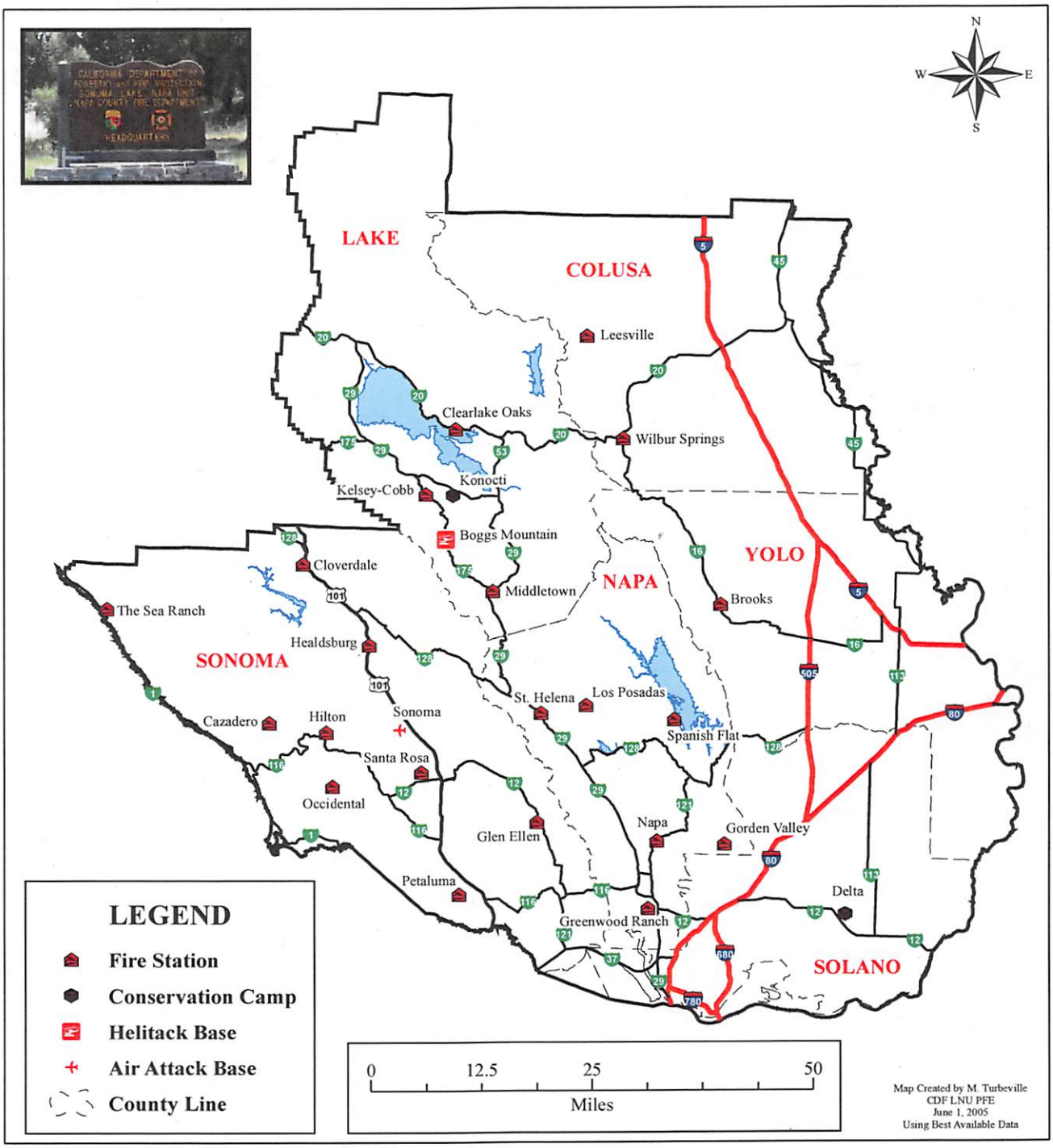


Figure 3: LNU Facility Map

IV. COLOBORATION

Fire as a process, involves the proper combination of three elements: heat, oxygen, and fuel. A wildfire doesn't conform to jurisdictional boundaries. It burns wherever the three elements are present. Therefore, a wildfire, regardless of size, can impact a wide variety of stakeholders. A stakeholder can be any person, agency, or organization with a particular interest in fire safety and protection of assets from wildland fire. In LNU this includes, but isn't limited to, the fire protection professionals from more than 100 paid and volunteer fire departments, nearly one hundred active Volunteers-in-Prevention (VIP), planning staffs from the six counties, air quality staff from six separate air quality districts, and dozens of citizens groups, both formal and ad-hoc, that have engaged the issue of fire protection in their respective communities. In LNU, we recognize that such engagement takes many approaches. In fact, our stakeholders have taught us everything, it is that there is no such thing as a single "standard approach" to reducing costs and losses due to wildfire.

In some instances, concerned citizens have formed exclusively around the issue of fire, in which case they are known as "firesafe councils." In LNU, such councils have been formed at various levels of community and governance. For example, FireSafe Sonoma encompasses the entire County of Sonoma, while the South Lake FireSafe Council encompasses a portion of Lake County that has a common tradition resulting from a geographically influenced fire history and a fire protection district that evolved in response. At an even more local level, the Mt. Veeder FireSafe Council in Napa County is oriented toward a specific community with its' own unique fire safety concerns.

In other instances, long-established community groups can be considered functionally equivalent to firesafe councils. Examples include the Hidden Valley Lake Homeowners Association in Lake County, the Berryessa Estate Homeowners Association and the Circle Oaks Homeowners Association in Napa County, and the Fountaingrove Open Space Maintenance Association and the Fitch Mountain Neighborhood Association in Sonoma County, all of which have worked for years with local CDF representatives to implement community defense wildfire protection projects. Neighborhood and homeowner groups like these have been in existence for many years and have a long history of addressing common problems of local land use and development, watershed issues, and other local community environmental concerns. On the northern Sonoma Coast, The Sea Ranch has its' own fire management plan dating back to the

Photo 2: Typical The Sea Ranch Structure and Landscaping

1980s aimed at increasing community wildfire awareness, and the implementation of a combination of fuel breaks and fuel reduction to protect assets, mainly structures, at risk. Dealing with the challenges posed by wildfire is often consistent with these longstanding local approaches.

Other local stakeholders include public and private institutions, such as Pacific Union College, St. Helena Hospital and Health Center, and the California Veterans Home, all in Napa County; the Audubon Society in Yolo County; the CalPine Energy Corporation and the Northern California Power Authority, both geothermal energy producers in the Geysers area of Sonoma and Lake Counties; Pacific Gas & Electric, and numerous Resource Conservation Districts throughout the six county area. Unit staff has long worked with every one of these institutions to implement pre-fire management projects of various types.

Various local, state, and federal government agencies also have major stakes in fire safety and protection of assets from wildland fire. At the federal level, LNU has worked closely with the USDI Bureau of Land Management's (BLM) Ukiah Field Office, USDA Forest Service's (USFS) Mendocino National Forest, and the U.S. Army Corps of Engineers on numerous pre-fire management projects over the years. State agencies include the Department of Fish and Game, State Lands Commission, and the Department of Parks and Recreation. The Unit currently has either active or recently completed Vegetation Management Program (VMP) projects on lands administered by each of these agencies.

Photo 3: U.S. Army Corps Lake Sonoma Prescribed Burn in November 2002

The Unit works closely with more than 100 volunteer and paid fire departments. In Napa County, the Unit fulfills a dual function as the Napa County Fire Department. In June of 2003, the Unit partnered with the county fire and planning departments of Napa and Sonoma Counties in co-sponsorship of a regional FireWise Community Workshop that engaged many of the stakeholders mentioned above in the Unit's fire management planning process. This process continues today as the Napa FIREWISE Program, which has the full endorsement of the Napa County Board of Supervisors. In its' third year, this countywide program has received more than $500,000 in federal wildland urban interface (WUI) grant funding. Over and over again, the key issue that arises in all these forums is the growing WUI problem and the related problem of decreasing availability and affordability of homeowner's insurance.

A second key issue in the Unit is the unique class of assets at risk in the Geysers geothermal field where capital improvements that are valued in excess of four billion dollars are vulnerable to some of the heaviest wildland fuel loadings in the Unit. Not only are these facilities at risk to wildfire, they also pose the risk of ignition to themselves, particularly due to numerous high-voltage transmission lines associated with the power plants that generate and deliver electricity to over one million Californians daily. Refer to Appendix A regarding a success story regarding last year's Geysers Fire.

Photo 4: Unit 18 in The Geysers

V. GEOGRAPHIC INFORMATION SYSTEM METHODOLOGY

To facilitate understanding the figures, maps, and descriptions provided in this Plan, it is important to discuss how geographic information system (GIS) was used for analysis. GIS is software "tool" that applies data to be displayed as part of a map. A point, or area, can be assigned specific attributes that then can be used for map symbolization. The attribute forms a database. While producing a map is valuable for visualizing attributes, the real benefit of using GIS is for modeling, or completing calculations based upon attributes. The output of the modeling can then be incorporated into a map that shows the viewer the end product of the modeling process. Once a model is built, a vast area represented by GIS compatible data can be processed.

In order to represent such variables as assets at risk, fuels, and topographic factors that exist throughout California, a grid network was developed. It is impractical to have very small grids, though it would be more accurate, to represent the various factors for the entire State. Therefore, the grid network was derived by sectioning every 7.5-minute United States Geographic Society (USGS) quadrangle map into a 9 x 9 grid to create eight-one cells. Each cell is 450 acres and is referred to as a "Quad Eight-firsts" ($Q81^{st}$). $Q81^{st}$ are used for all fire plan assessments, with each $Q81^{st}$ having attributes that describe the majority of the represented 450 acres. Refer to Figure 4 on the following page.

At a large scale, such as at the full extent of LNU, the "block" appearance of each $Q81^{st}$ is somewhat disguised, but if the user wants to zoom into a specific area, perhaps down to even to a property parcel, the parcel may not be accurately represented by the broad classification of the 450 acre $Q81^{st}$. For this type of user, and to more accurately complete the fire plan assessments, a smaller grid needs to be developed.

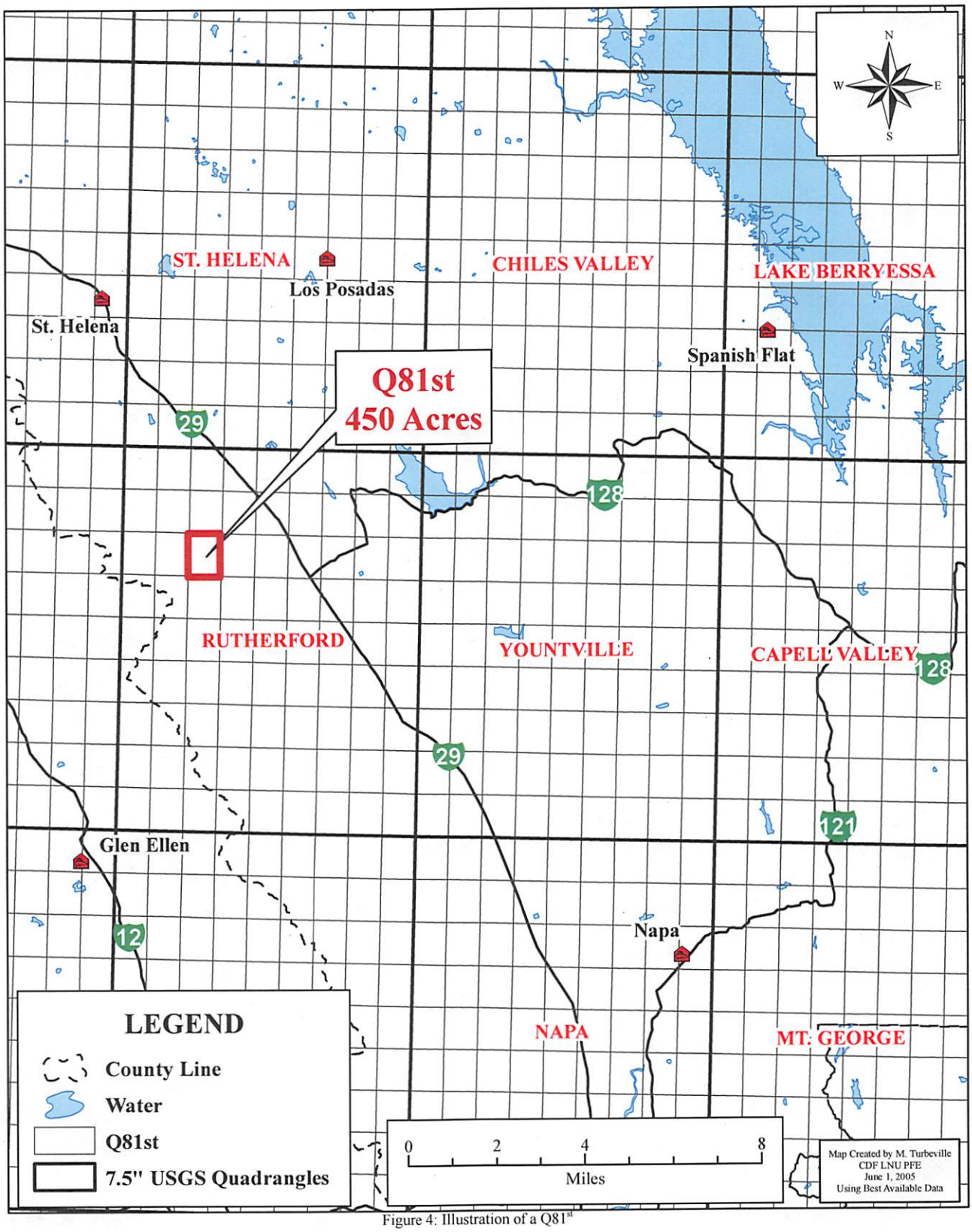


Figure 4: Illustration of a Q81st

VI. ASSETS AT RISK

The primary purpose of wildland fire protection is to safeguard the wide range of assets than can be threatened by wildfire. Assets at risk refer to real and societal values that have the potential to be burned or damaged by wildfire. In LNU, these assets include life and safety, structures, water and watershed values, agriculture, rangeland, recreation, air quality, soil resources, wildlife, unique scenic areas, cultural and historic resources. Among the Unit's assets at risk are some of the world's most valuable agricultural lands, which are often interspersed with high-value real estate, both residential and commercial. Sixteen assets have been identified by the State Fire Plan and ranked as to their risk from wildfire. The table on the next page provides a description of the assets evaluated.

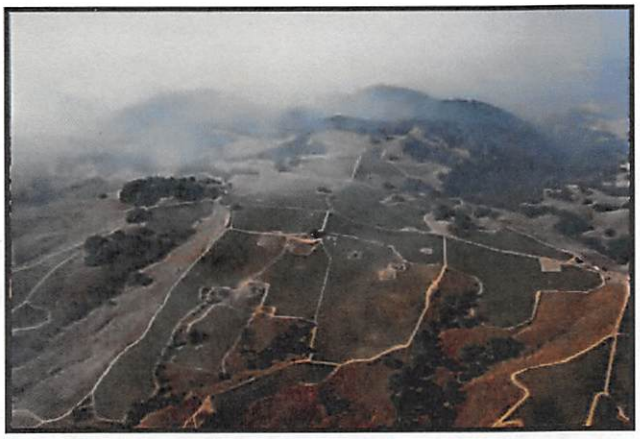


Photo 5: LNU Agricultural Land Use

The resident population within the Unit is more than 1.2 million. Suburban populations are booming in the southern end of the Unit, particularly in Solano County, along the Interstate 80 corridor that links San Francisco and Sacramento. As available Local Responsibility Area (LRA) lands are used for residential, industrial, and agricultural purposes, there is increasing pressure for development in SRA lands. Accelerated growth is occurring in the population centers of Santa Rosa, Petaluma, Windsor, Healdsburg, Cloverdale, Vacaville, Fairfield, Vallejo, and Lake County. All of these areas are characterized b a growing wildland urban interface (WUI) fire problem.

In addition more than an estimated five million tourists travel through the Unit each year, taking part in a wide variety of recreational activities from wine tasting to enjoying the waterways. The fire ignition history in the Unit is consistent with these human use factors and the state highway and county road corridors.

The Geysers geothermal field, which is located in the Clear Lake Volcanic Area straddling Sonoma and Lake Counties, is a unique asset at risk, and one that plays a large role in the Unit's wildfire protection planning. The complex is comprised of dozens of high value structures, including 22 power generating plants scattered over 30,000 acres of remote, steep, and broken topography of the Mayacamas Mountains. This geothermal field is the largest and most productive in the world. It has an estimated electrical generating capacity of over 2,000 megawatts and supplies power, day in and day out, to over one million California residents. More than four billion dollars in capital improvements is at risk to wildfire in the midst of some of the Unit's most high hazard wildland fuels. The numerous power-generating activities are not only at risk to wildfire, but also have periodically been sources of ignition.

Asset at Risk	Public Issue Category	Location and Ranking Methodology
Hydroelectric Power	Public Welfare	1) Watersheds that feed run of the river power plants are ranked based on plant capacity. 2) Q81st cells adjacent to reservoir-based powerplants receive a low rank. 3) Q81st cells containing canals and flumes receive a high rank.
Fire-Flood Watersheds	Public Safety Public Welfare	Watersheds with a history or problems or the "proper" conditions for future problems. Rank is based on affected downstream population.
Soil Erosion	Environment	Watersheds ranked based on erosion potential.
Water Storage	Public Welfare	Watershed area up to 20 miles upstream from water storage facility, rank based on water value and dead storage capacity of reservoir.
Water Supply	Public Health	1) Watersheds that are up to 20 miles upstream from water supply facility receive a high rank. 2) Q81st cells containing domestic water diversions are ranked based on number of connections. 3) Q81st cells containing ditches that contribute to the water supply system assigned a high rank.
Scenic	Public Welfare	Four mile viewshed around scenic highways and ¼-mile viewshed around wild and scenic rivers; rank is based on potential impacts to vegetation types (tree vs. non-tree specie type.
Timber	Public Welfare	Timberlands' rank based on values and susceptibility to damage.
Range	Public Welfare	Rangelands' rank based on potential replacement feed cost by region, owner, and vegetation type.
Air Quality	Public Health Environment Public Welfare	Potential damages to health, materials, vegetation, and visibility. Rank is based on vegetation type and air basin.
Historic Buildings	Public Welfare	Historic buildings ranked based on fire susceptibility.
Recreation	Public Welfare	Unique recreation areas or areas with potential damage to facilities. Rank is based on susceptibility.
Structures	Public Safety Public Welfare	Ranking based on housing density and fire susceptibility.
Non-game Wildlife	Environment Public Welfare	Critical habitats and species locations based on input from the California Department of Fish and Game, and other stakeholders.
Game Wildlife	Environment Public Welfare	Critical habitats and species locations based on input from the California Department of Fish and Game, and other stakeholders.
Infrastructure	Public Safety Public Welfare	Infrastructure for delivery of emergency and other critical services (e.g.: repeater sites, transmission lines)
Ecosystem Health	Environment	Ranking based on vegetation type and fuel characteristics.

Table 2: Assets at Risk Description

Assessment of the type, magnitude, and location of assets at risk to wildfire is a critical element of pre-fire management. Because fire protection resources are limited, it is prudent to allocate them based, at least in part, in the value of the assets at risk. The total Assets at Risk map on the following page (Figure 5) represent an attempt to involve stakeholders in the evaluation of the Unit's wildfire protection system. All assets at risk are equally weighted and included in the modeling. The Q81st are then color-coded corresponding to the percentile in which they belong; i.e. the upper 5% is red.

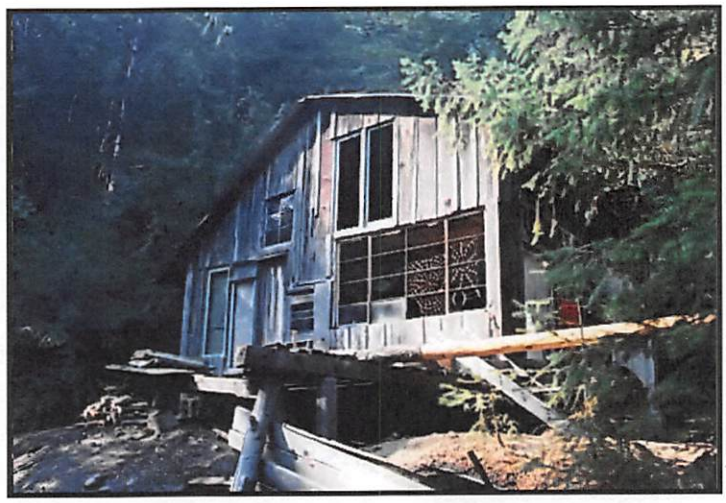


Photo 6: Remote Historical Structures

Areas with a high cumulative asset values can be further evaluated for wildfire hazard. The resulting high risk, high hazard map can be used to prioritize management activities. The initial risk ranking is a somewhat subjective process, though it benefits from the professional judgment and knowledge of the Unit's fire professional staff. In this initial assessment, structures were given the highest weight, timber, infrastructure, water storage, and water supply were given a moderate weight, and all other assets were weighted at relatively low risk from wildfire. The resulting map is currently undergoing wide stakeholder review, and is subject to change over time. Refer to Figure 6.

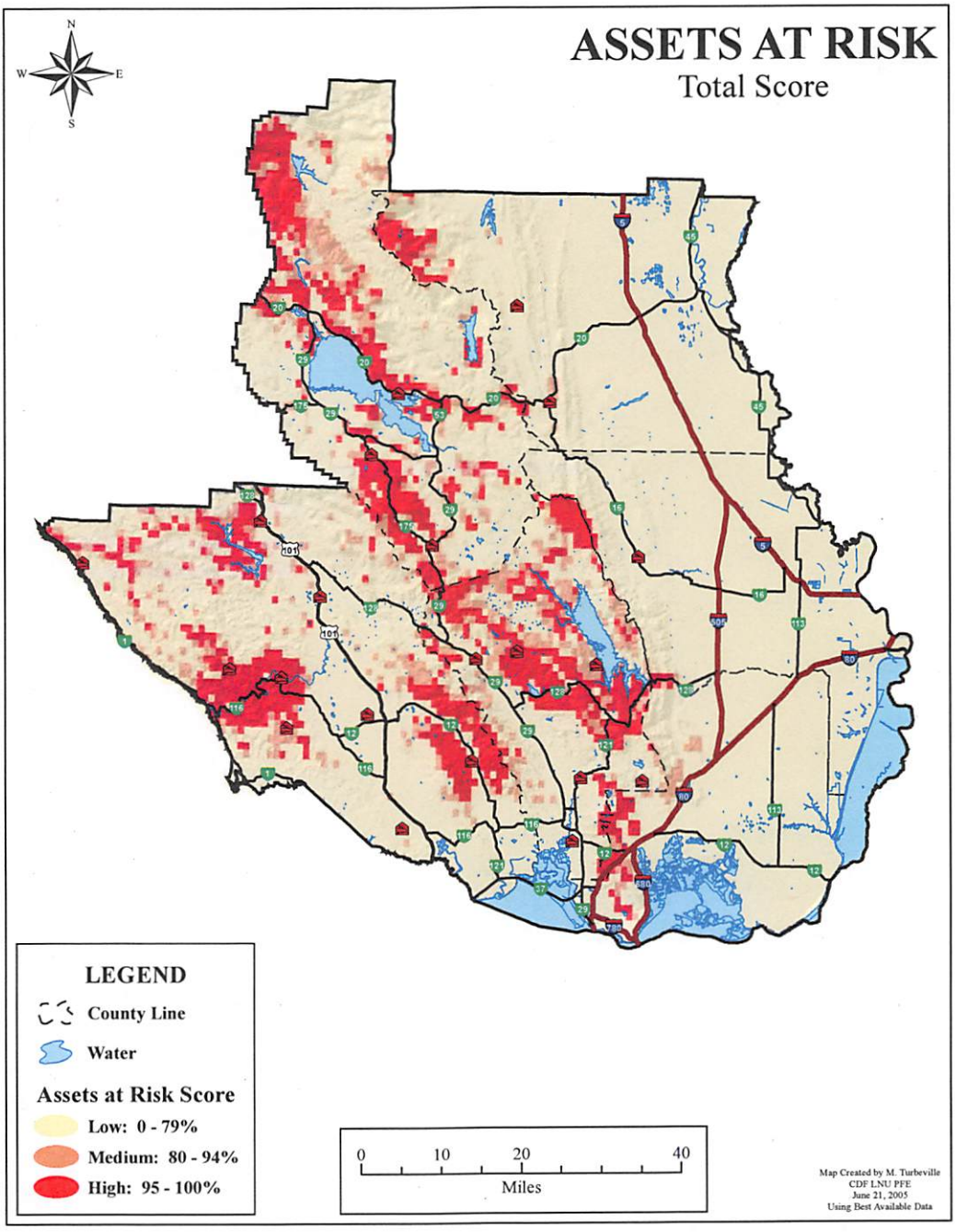


Figure 5: Assets at Risk Map (Total Score)

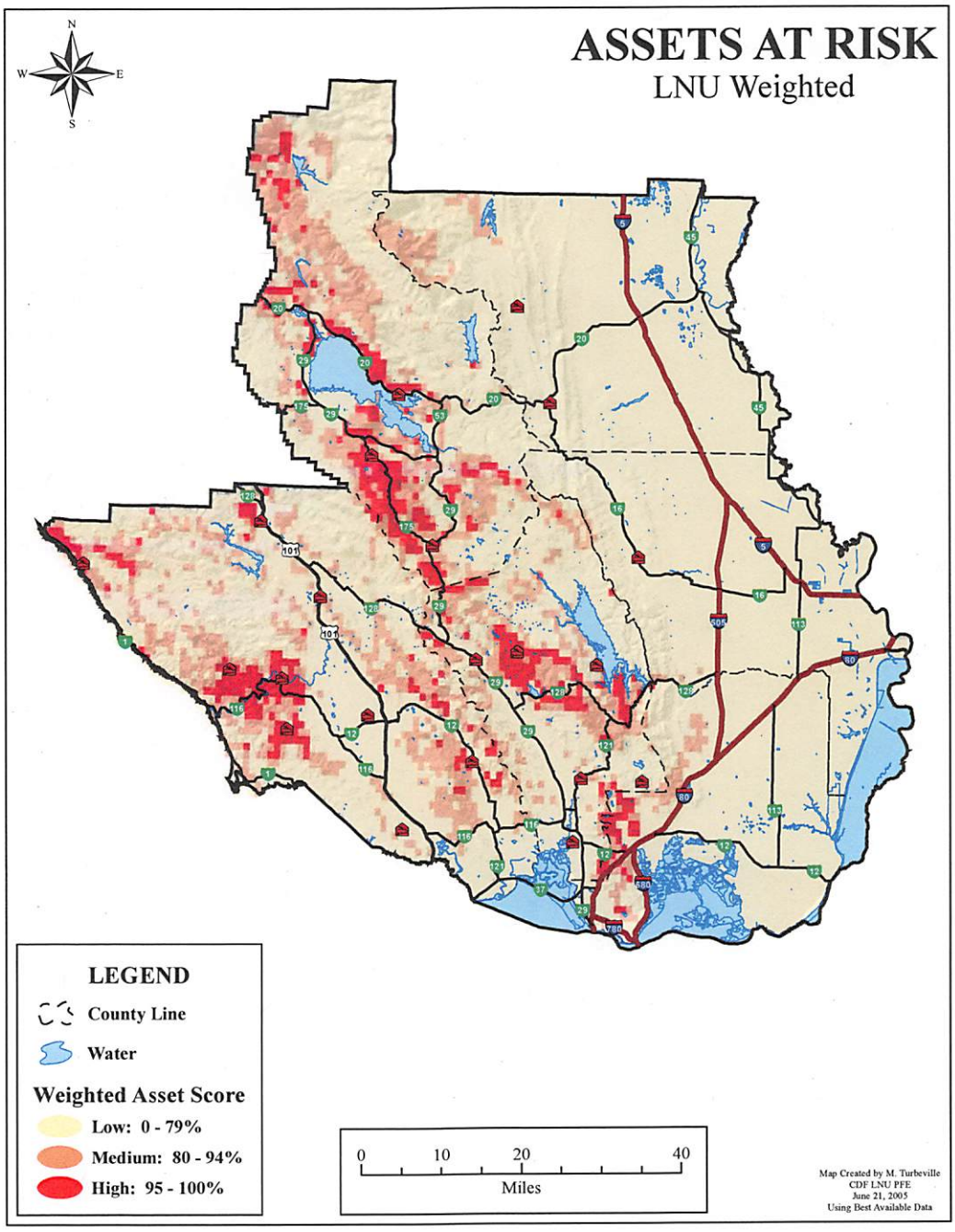


Figure 6: LNU Weighted Assets at Risk Map

VII. THE FIRE SITUATION

A. Local Fire Problem

The Sonoma-Lake-Napa Unit is not only the largest CDF Unit, but is also has one of the most diverse fire landscapes for any comparable sized area in the world. The Unit spans an area from the Pacific Ocean on the west, to the San Francisco Bay to the south, and the Sacramento Valley to the east. The Mendocino Unit and the Mendocino National Forest bound it to the north. Elevations range from sea level to nearly 5,000 feet (Figure 7), and it is not uncommon to have a 30 – 50 degree Fahrenheit range of temperatures in the Unit on a summer day. Nearly every major fuel type in California exists within the Unit's boundary, including grasslands, oak woodlands, brush, unique redwood forests, mixed conifer forests, and hardwood forests. The only fuel model not found is the desert type. Because of the extreme vegetative and climatic diversity, the Unit experiences virtually any type of wildfire that can occur in California, from fast spreading grass fires to full-blown forest fires. This means the Unit's fire protection system must be extremely versatile and adaptable.

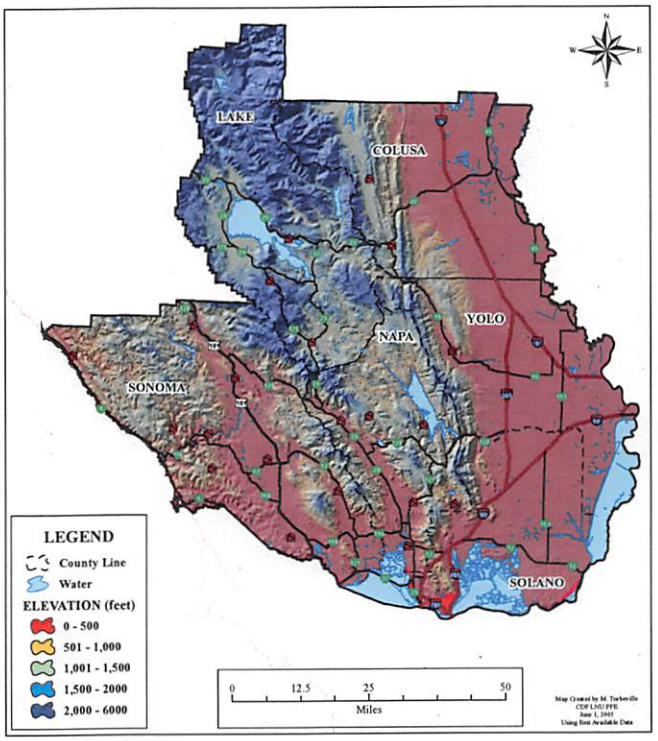


Figure 7: LNU Elevation

It has long been observed that certain areas are prone to wildfires again and again. These "historic wildfire corridors" occur where topography, fuels, and weather combine to channel large and damaging fires in particular locations. Well-documented examples include the mountainous area of western San Fernando Valley near Santa Susana Pass, Newhall Pass Canyon, and the Santa Monica Mountains between Topanga Canyon in Los Angeles County and Point Magu in Ventura Canyon. Other examples include the Cajon Pass in San Bernardino County, and the Oakland and Berkeley Hills in Alameda County.[5]

While most of the Unit has burned at least once since the beginning of organized fire protection, there are several areas of the Unit that have burned with such frequency as

[5] "Historic Wildfire Corridors," J. Meehan. Fire Management Notes, 1993 Vol. 54 No. 1

to exhibit the characteristic of historic wildfire corridors (Figure 8). Prominent among these areas are:

- The Geysers Geothermal Resources Area
- Lake Berryessa
- Rumsey Canyon
- Mt. St. Helena
- Cow Mountain
- North of Clear Lake
- N

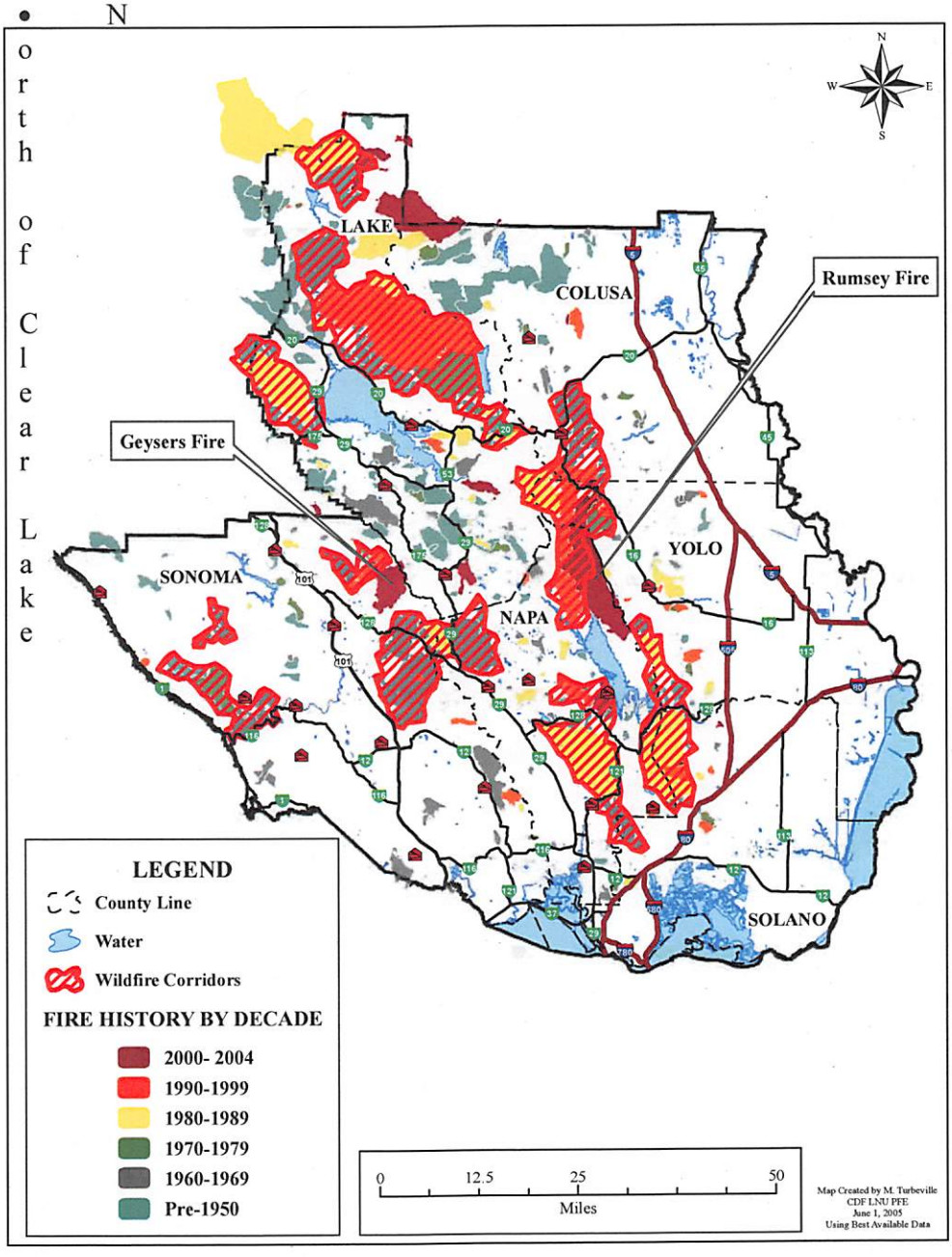


Figure 8: LNU Fire History with Wildfire Corridors

It is interesting to note that two of the largest fires, by acreage, in California during the 2004 fire season were located in LNU. The Geysers Fire started on September 3 and was contained on September 8 after burning 12,525 acres, and the Rumsey Fire started on October 10, contained on October 16, and consumed 39,138 acres. The Geysers Fire was located immediately adjacent to an area mentioned above, and the Rumsey Fire started in the Rumsey Canyon area.

The human impact on the local fire problem is inextricably linked with the natural factors that favor historic wildfire corridors. The Unit contains agricultural, industrial, and recreational populations, as well as an increasing commuter population working in the greater San Francisco Bay Area. The fire ignition history in the Unit is consistent with these human use factors and the state highway and county road corridors. A half dozen population centers account for approximately 80% of the Unit's ignition history, with three major recreation areas (Clear Lake, Lake Berryessa, and Lake Sonoma) accounting for another 10%. Agricultural and recreational equipment use account for the greatest proportions of ignitions, followed by debris burning.

Photo 7: Geysers Fire Perimeter and Surrounding Vineyards

B. Desired Future Condition

Wildfire will never be completely eliminated from the landscape. As an element of California's ecology, it is natural and inevitable as wind or rain. All the factors that effect wildland fire behavior can be categorized into three environment elements: weather, topography, and fuel. It is unlikely that humans will ever be able to control, manage, or change the effects of weather or topography on wildfire behavior. But it is possible to manage fuel, both vegetative and structural, which provides the basis for fire protection planning. Managing fuel is the focus of LNU's Fire Management Plan.

The goal of this Plan is to create not just a heightened awareness of wildfire, but a "fire safe" environment where citizens can continue to live, work, and recreate in the areas that are prone to wildfire; that is, most of the wildland areas of California. To ensure this, the Plan sets out to educate the citizenry to the hazards and risk of wildfire and to engage them in the development of appropriate actions to minimize the negative impacts resulting from wildfire.

As fire management plans are successfully institutionalized, it is expected that the general public will grow in understanding of living in a wildfire prone environment. This Plan will help focus citizens and other stakeholders into developing mitigation strategies and specific projects to implement them. Hopefully, defensible space around structures, firewise building practices, adequate water supplies, and fire equipment access will become as commonplace as smoke alarms and fire extinguishers are today in residential and commercial occupancies.

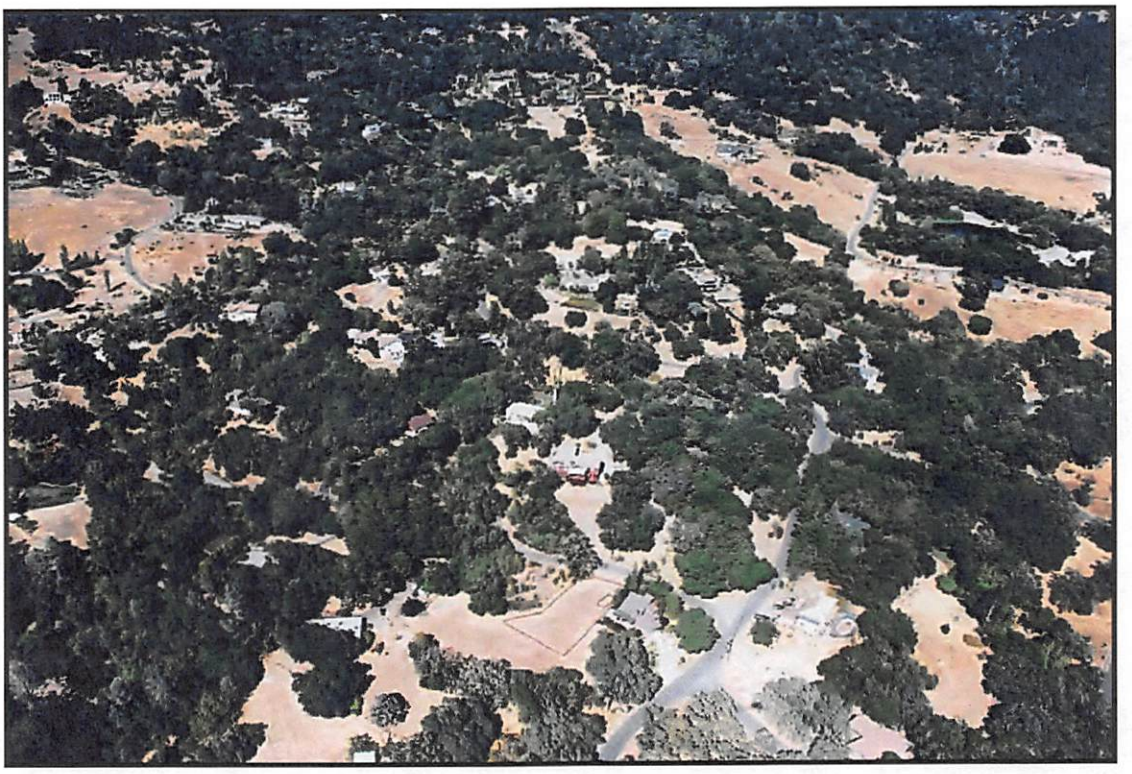


Photo 8: Palomino Lakes Subdivision near Cloverdale

In the near-term, public outreach programs and fuel reduction projects will be implemented, many using grant funds. But in the long-term, these programs will become institutionalized, a feature of "living with wildfire." Community-wide fuel management projects will be integrated into aspects of community well being on the same order of priority as community water supply, waste collection systems, flood and erosion control, and neighborhood beautification. Catastrophic wildfire losses will become as rare, or nonexistent, as catastrophic fires in schools, hospitals, high-rises, or any other category of occupancy that has had its' fire risk mitigated aggressively over the years through built-in fire protection measures.

Wildfires will continue to occur in California. But in the desired future condition, humans will weather them with little more difficulty than they currently weather the wind and rain. Why? Because they will view wildfire realistically, not as something that "can't

happen here," but as a phenomenon that not only can happen, but probably will happen. Along with the realistic assessment of wildfire risk will come the realization that much can be done to prepare for and mitigate the wildfire hazard, and that local fire management plans, or Community Wildfire Protection Plans (CWPP) are a prime vehicle for accomplishing this.

C. Ignition Workload Assessment (Level of Service)

The ignition workload assessment is meant to focus on identifying those areas with the highest potential of experiencing unacceptable loss and high suppression cost wildfires. One key to mitigating this potential is the successful mobilization of firefighting resources in a timely manner. It is the purpose of the ignition workload analysis to assess how successful CDF has been in providing equal fire protection to similar lands, and to identify where this goal is not being achieved and improvement is needed.

Photo 9: Example of CDF's Fire Suppression

The intent of the California Fire Plan methodology is to use ignition data to analyze fire intensity, damage, cause, vegetation type, and initial attack success or failure. "Success" or "failure" in this system is a theoretical construct based on subjective evaluation, after the fact, of the level of firefighting resource commitment and ultimate fire size. The validity of analysis is limited if it neglects to take into account such factors as the commitment of resources to other fires or incidents when a new fire starts, operational discretion, and extreme fire weather conditions that may not be reflected in burned acreage numbers. For example, a fire that burns more acres than the theoretical threshold determined by vegetation type may be deemed a "failure," while in reality, operational tactics may have resulted in asset protection at the expense of more acres of burned wildland vegetation. In realm of wildland firefighting, such operational results would be considered a "success."

Photo 10: Remote Activated Weather Station (RAWS)

One of the major inputs into the ignition workload assessment is the accurate determination and documentation of weather conditions at the time of ignition. Essentially, this assessment is most valid in areas where reliable and representative weather data is continuously available. Unfortunately, this isn't the case in many areas of the State, including large portions of LNU. It isn't unusual in the summer, for example, for coastal portions of the Unit to be bathed in fog with temperatures in the 50s, while at the same time, further inland temperatures may be in the 90s and the burning conditions are extreme. The same type of variation can be attributed to

elevation differences, being above or below the fog. Because of the climatic diversity, it can be misleading to rely on the nearest available remote activated weather station (RAWS) data in such an assessment. Until the State is able to provide RAWS coverage that provides a comprehensive representation of California's fire environments, in all their diversity, this assessment will be most valid in those areas and units with relatively homogeneous weather and adequate RAWS coverage.

A benefit of using GIS is the ability to query the database that is being displayed in the maps. A query can also be done by a geographic area such as a county, response area, or a specific battalion. Using fire ignition data from January 6th, 1994 to February 2nd, 2005, which includes 3,663 ignitions, the following graph was developed to show fire causes by percentage per county along with the Unit's overall average.

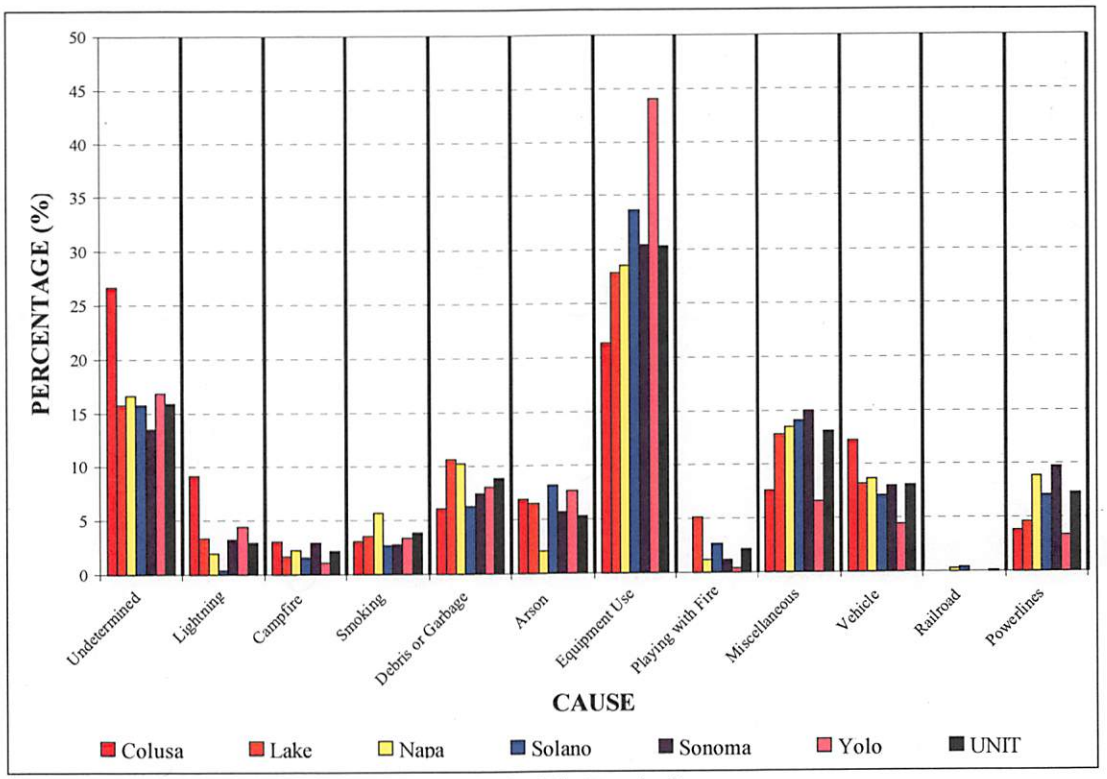


Figure 10: Graph of Fire Cause by County

The statistical map approximating initial attack workload assessment is depicted in Figure 11. The map is designed to show the effectiveness of the suppression organization in meeting the initial attack fire workload. The ignitions captured in the map are within the timeframe as the above graph. The attempt to control fires before they become large and costly is evaluated in this assessment. The underlying assumption is that fires, which are successfully contained in the initial attack[6] (IA) stage, are not the primary problem.

[6] Initial attack refers to the first set of resources sent by CDF upon being notified of a fire. If initial attack isn't successful, the response and strategy-situation is upgraded to extended attack with additional

Problem fires are the few that exceed initial attack suppression capabilities, generally due to extreme weather conditions, are costly to control and cause substantial damage. The large fires account for a majority of acreage that is burned in the State each year. Due to the lack of weather data for some areas, a number of failures appear as statistical anomalies; were they to be matched with representative weather data, which is not currently available; they would be recorded as "successes." Nevertheless, they are displayed in this analysis as an initial approximation. As further evaluation occurs to better match weather data with ignitions, the quality of this assessment will improve.

To create the map, the location of where each fire started, or in firefighting terminology, the "point of origin," are plotted in the center of the respective Public Land Survey (PLS) section, and color-coded based on success/failure scores. It is possible to have more than one point of origin per section. Where this occurs, the colored coded symbols are stacked upon one another. Figure 12 represents failure density or Q81st areas where more than one ignition has escaped initial attack.

resources being sent. The last response is "major," which is an extended that usually calls for the activation of an incident management team and resources responding from a much larger geographic area.

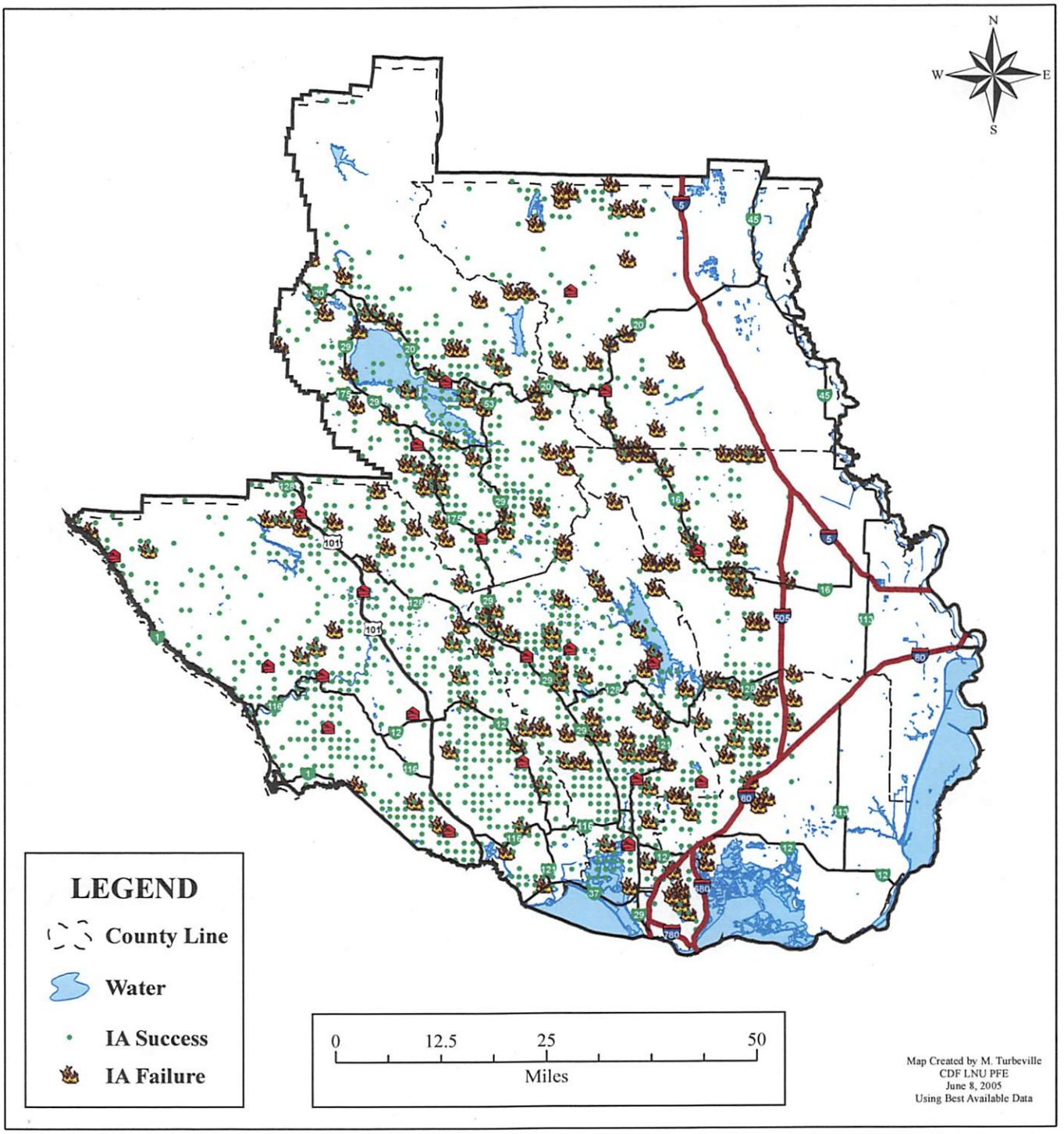


Figure 11: LNU Initial Attack Success and Failure

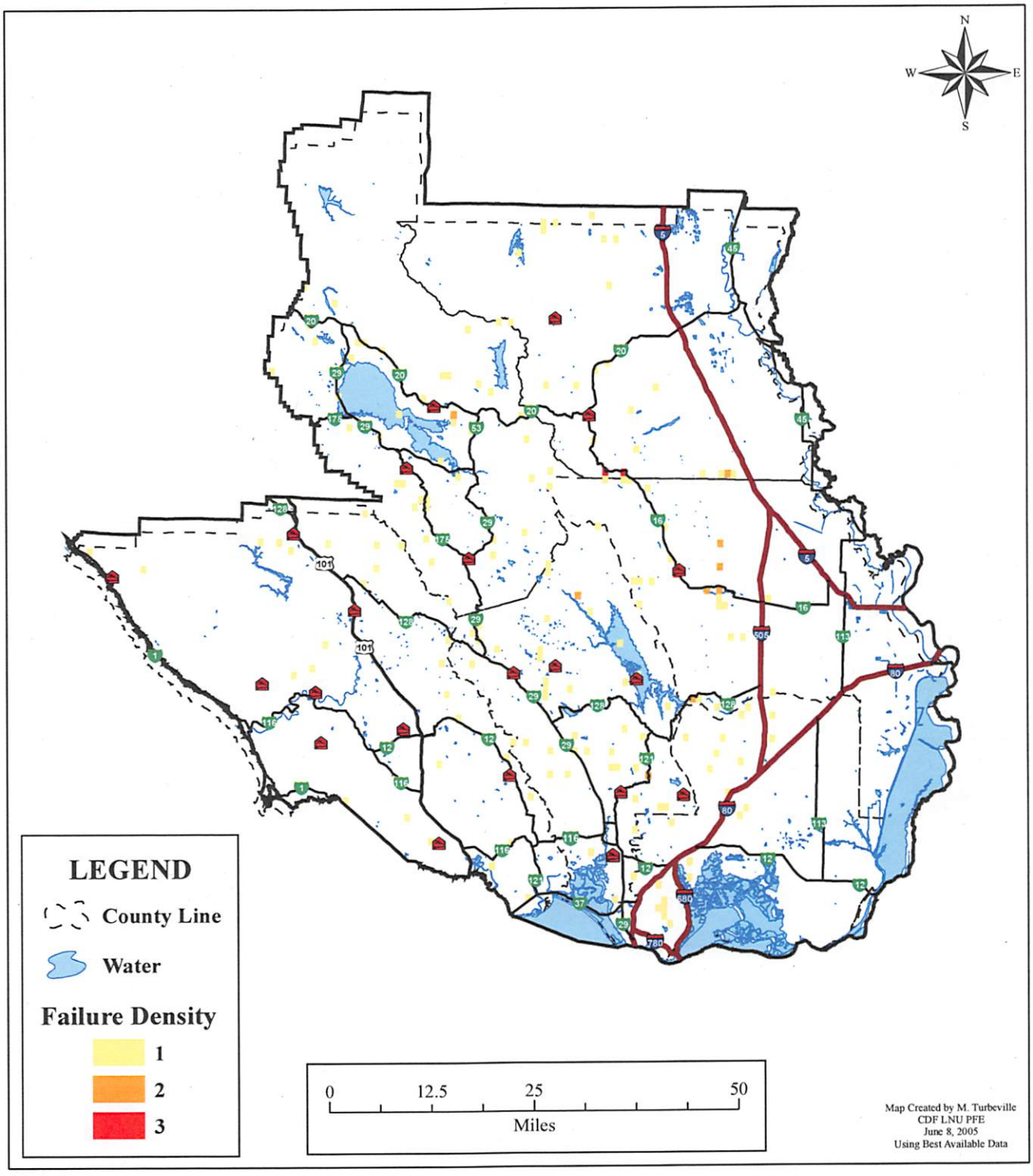


Figure 12: LNU Ignition Failure Density

1) Initial Attack Success and Failures

The legislature has charged the Board of Forestry and CDF with delivering a fire protection system that provides an equal level of protection for lands of similar type (Public Resources Code (PRC) 4130). In order to do this, CDF utilizes a process that evaluates the level of service currently afforded a particular wildland area with a predetermined level for each area. This rating is expressed as the percentage of fires that are successfully extinguished during initial attack. Success is defined as those fires that are controlled during the initial attack phase before unacceptable damage and cost are incurred.

California has a complex fire environment and CDF data on assets at risk relative to damage from wildfire is incomplete. These factors combine to make it very difficult to develop a true performance-based fire protection planning system. CDF has resorted to prescription-based fire protection planning, using such factors as response times, fire detection systems and associated reporting times, acreage goals, as a way to overcome the complexity of the issues. It is very hard to put "numbers" to factors that are subjective and/or don't lend themselves to being quantified, such as address posting, defensible space, and fire apparatus access, aircraft availability and response, water supply systems, etc. Unfortunately, prescription based planning tends to oversimplify some issues, For instance, prescription standards also make it difficult to integrate the interrelationships of various fire protection programs, such as the value of fuel reduction programs in reducing the level of fire protection effort required.

Despite the shortcomings of a prescription-based fire protection planning system, the Level of Service (LOS) rating can be used a "relative" system, which attempts to measure the impact of fire on the various assets at risk. The LOS rating can be readily used to describe the degree of success to stakeholders. The rating can also provide a way to integrate the contribution various program components of fire prevention, fire protection planning, vegetation management, and fire suppression toward the goal of keeping damage and cost within acceptable limits. It is important to reiterate that this system is a relative system and that the ratings are only approximate.

In the rating process, a fire may be considered a failure based upon the number of resources committed and the fire size. Obviously, this approach oversimplifies the myriad of factors that truly determine initial attack success, as has been discussed earlier in this Plan.

The LOS rating, mathematically, is a ratio of successful initial attack fire suppression efforts to the total number of fire starts. Refer to Figure 13 for the formula. It used GIS to graphically display the success and failures of the fire suppression resources by overlaying ten (10) years of wildfire history onto a map, as shown in Figure 11, and deriving the average annual number of fires by size, severity of burning conditions, and assets lost.

$$\text{Success Rate (\%)} = \frac{\text{Annual Number of Fires Extinguished by Initial Attack}}{\text{Total Number of Fires}} \times 100$$

Figure 13: Level of Service (LOS) Ratio Formula

The result is an initial attack success rate measured as a percentage of fires by vegetation type and area. Success is defined as those fires that are controlled before unacceptable damage and cost are incurred and where initial attack resources are sufficient to control wildfires.

Rather than apply the LOS formula to all wildfires they are separated by which fuel type, or planning belt, the fire burned. Then within each planning belt, fires are further classified based on final size and weather conditions at the time of ignition. Each fire is in turn classified as either a successful initial attack or a failure. Failures are defined by planning belt as follows:

- Grass: 12 acres and greater
- Brush: 6 acres and greater
- Timber (Coastal and Interior Conifer): 3 acres and greater
- Woodland: 15 acres and greater

The analysis time period for Table 3 is the same as Figure 11, January 6th, 1994 through February 2nd, 2005. The planning belt vegetation types were analyzed independently. A cumulative initial attack success rate of 95% was observed for this period of time. State values are also included for comparision.

Planning Belt	Success Rate		Successful I.A.		Failure I.A.	
	LNU	State	LNU	State	LNU	State
Grass	97%	95%	924	20,339	33	1,039
Brush	90%	94%	500	16,600	54	1,099
Coastal Conifer	98%	98%	263	2,534	5	48
Interior Conifer	94%	95%	774	19,092	46	1,040
Woodland	98%	97%	186	9,622	4	335
Not Classified	96%	97%	837	33,852	38	1,191
AVERAGE	**95%**	**96%**	3,484	102,039	180	4,752

Table 3: Initial Attack Successes and Failures

D. Vegetative Wildfire Fuels

Photo 11: Chemise

As mentioned previously, all the factors that effect wildland fire behavior can be categorized into three environmental elements: weather, topography, and fuel. Wildland fire fuels refer to all combustible material available to burn within a given area of land. There are four universally agreed upon fuel types as defined by the National Wildfire Coordination Group (NWCG); grass, shrub, timber litter, and logging slash. Each fuel type has its' own set of fuel characteristics dependent upon several inherent factors. NWCG outlines these fuel characteristics as[7]:

- **Chemical Content**: Substances in the fuels which can either retard or increase the rate of combustion, such as high mineral content, oils, resins, wax, or pitch.
- **Compactness:** The spacing between fine particles. This can be especially important in the surface layer of fuels, where the amount of air circulation affects rate of drying, rate of combustion, etc.
- **Fuel Loading**: The oven-dry weight of fuels in a given area, usually expressed in tons per acre. Fuel loading may be referenced to fuel size or timelag categories; and may include surface fuels or total fuels.
- **Fuel Moisture**: The amount of water in a fuel, expresses as percentage of the oven-dry weight of that fuel.
- **Horizontal Continuity**: The horizontal distribution of fuels at various levels or planes. Two categories: patchy or uniform.
- **Size and Shape**: Affects the fuel moisture timelag, the amount of heat required for ignition and to sustain combustion, and the burnout time of fuels. Surface-area-to-volume ratio is a representation of size and shape.
- **Vertical Arrangement**: The relative heights of fuels above the ground and their vertical continuity, which influences fire reaching various levels or strata. (Surface fuels vs. aerial fuels, and their relationships to one another.)

[7] NWCG S-290 Intermediate Fire Behavior NFES 2378 July 1994.

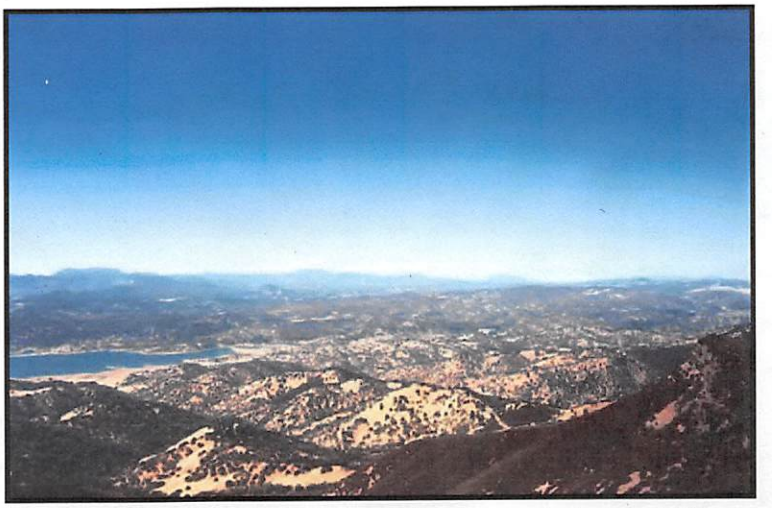


Photo 12: View of Napa and Lake Counties from Berryessa Lookout circa 2001

All of the factors contribute to fire spread, intensity, and threats to assets at risk. And recognizing that it is the only environmental factor we can easily modify, it is important to understand this fact. As an example, consider fire intensity. It is directly related to fuel loading, which is measured in tons per acre. Grass is considered a light fuel at less than one ton per acre, while brush, at up to fifteen tons per acre, is considered a heavy fuel. Some timber stands comprise extremely heavy fuels loads, especially in the coastal conifer type, which may have fuel loadings in excess of fifty tons per acre. Lighter fuels burn with a more rapid rate of spread and are characterized by a relatively short period of intense heat output. Brush and timber, on the other hand, exhibit a somewhat slower rate of spread, but a very high output and longer residual heat production. So, the fuel loading fuel characteristic factor effects fire behavior, and consequently fire suppression strategies and tactics. This in turn dictates resource needs.

The United States Forest Service (USFS) has developed thirteen fuel models that categorize fuels by their "burn" characteristics, for the purpose of estimating fire behavior. They were developed to be used throughout the Nation, and scientifically are a "set of numbers" that when inputted into a computer model, represent how a certain fuel model will burn. There are three grass fuel models, four shrub, three timber litter, and three logging slash. Following is a short description of each fuel model from "Aids to Determining Fuel Models for Estimating Fire Behavior[8]:"

[8] Aids to Determining Fuel Models. Anderson, Hal E. 1982 USDA Forest Service Technical Report INT-122.

Fuel Type	Fuel Model	Description
GRASS	1	This model is used for short; generally below knee level or about one foot tall, fine textured grass that best represents typical grasslands and savannas. Less than one-third of the area has other vegetation like shrubs or trees. No live fuel moisture. Fuel loading ranges from ½ - ¾ of a ton per acre. Fires burn rapidly with flame lengths averaging four feet.
	2	Dominated by grass about one to two feet tall, usually under an open wooded or timber canopy. Four to five tons of fuel is found per acre and the fuel bed depth is one to two feet. Model contains live fuel moisture. Litter from tree canopy and species composition increases fire intensity but reduces fire spread.
	3	Not applicable to LNU.
SHRUB	4	Brush model and is characterized by stands of mature brush six feet or more in height with continuous, interlinking crowns, with fuel load ranging from fifteen to eighty tons per acre. No live fuel moisture. Fires in this fuel model burn intensely and spread very quickly.
	5	Same specie composition as fuel model four, but individual plants are shorter, usually sparser, and less mature with little or no dead component. Contains live fuel moisture. Occurs on poor sites, on recent burns, and may occur under tree canopies. Fires in this fuel model do not burn as intensively, nor rapidly due to higher concentrations of live-to-dead fuel.
	6	Consists of vegetation that is taller and more flammable than that of model five, but not as tall or as dense as model four. Interior live oak, young chemise and manzanita, area all considered species associated with this model. In many instances a fuel model five will evolve into a fuel model six by the latter part of the summer. Fires in this model will burn in the foliage of standing vegetation, but only when wind speeds are greater than eight miles per hour. Fires burn with an average flame length of six feet.
	7	Not applicable to LNU.

Fuel Type	Fuel Model	Description
TIMBER LLITER	8	Mainly needles, leaves, and occasionally twigs because there is little undergrowth below a conifer or hardwood canopy. May contain occasional "jackpots," or heavy accumulations of fuel. Closed canopy stands of short needle conifers or hardwoods that have leafed out support fire in the compact litter layer. No live fuel moisture. Fires in this model burn slowly due to compaction, and do not pose control threat unless there is high temperatures, low relative humidity, and high winds that allow the fire to spread into the canopy. Symbolic of what is created by a shaded fuel break.
	9	Similar to a model eight, except has more fine fuels, about two to four tons per acre, which create a deeper and not as compact layer of leaves and needles. Fires burn with more intensity than fuel model eight with flame lengths from three to six feet.
	10	A shrub, sapling, or immature tree understory with a loading of fine fuels from three to four tons per acre and a "heavy" loading of more than twelve tons per acre. Fires in this model burn with a moderate rate of spread, flame lengths ranging from six to ten feet. There is also occasional individual torching of trees, which can cause embers to be cast and start spot fires. Poses the most control problems of the three timber litter models.
LOGGING SLASH	11	Not applicable to LNU.
	12	Not applicable to LNU.
	13	Not applicable to LNU.

Table 4: Fuel Model Descriptions

In order to analyze where "hazardous" fuels exist that will threaten any assets at risk or cause resistance to fire suppression, the fuel models were used in conjunction with GIS to create "planning belts." Generally speaking, all lands mapped in a particular planning belt will exhibit similar fire behavior characteristics that impact suppression activities, and thus are subject to similar planning consideration. These planning belts are displayed in Figure 14.

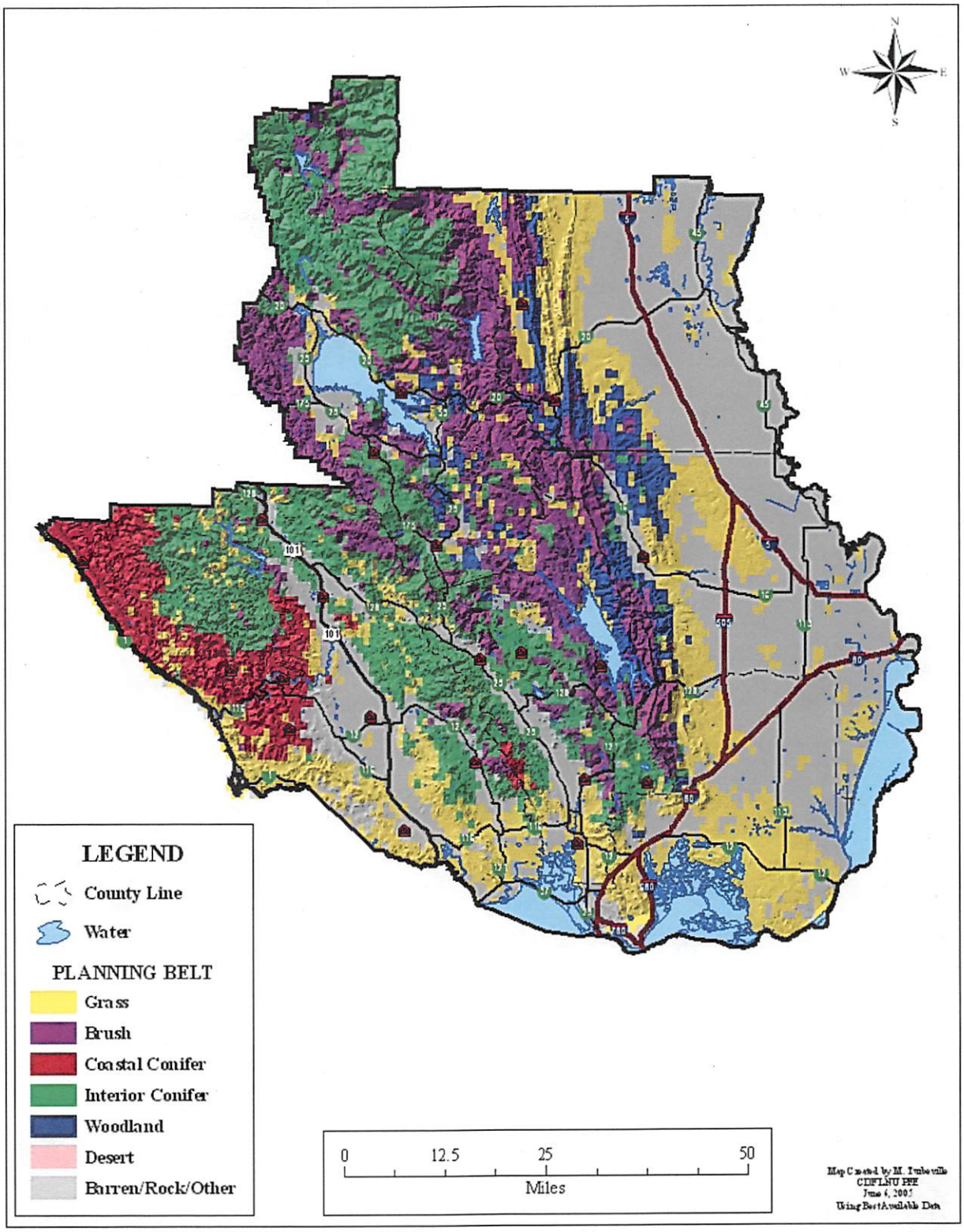


Figure 14: LNU Planning Belts

To derive fuel rank, or fuel hazard ranking, other factors are combined with the fuel type and modeled. The first step in the process is combining the fuel models by their slope location classification. Unique fuel model-slope combinations were created using the fuel models and six slope categories: 0-10%, 11-25%, 26-40%, 41-55%, 56-75%, and over 76%. Using BEHAVE fire modeling software the outputs for each fuel model-slope combination was plotted on a rate of spread vs. heat per unit area graph, and the results were divided into three "surface ranks."

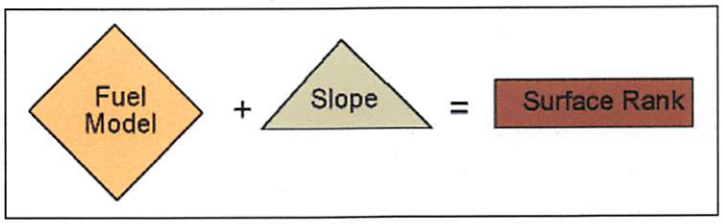


Figure 15: Fuel Assessment Process #1

After the surface rank was determined, the additional fuel factors of ladder and crown index where combined to create a "fuel rank." These factors indicate the probability that torching and crown fire will occur if the vegetation were subjected to a wildfire under adverse fire weather conditions. Thus this ranking includes the hazards of canopy involvement in fire along with the surface fire. The BEHAVE software is used again to complete this step using unique combinations of topography and fuel under given weather conditions.

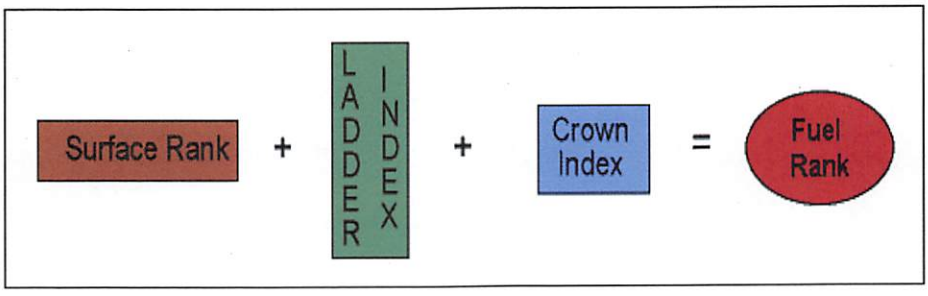


Figure 16: Fuel Assessment Process #2

The potential fire behavior drives the hazard ranking. The resulting fuel rank is assigned to each Q81st within the Unit's SRA to comprise an approximation of the local wildfire hazard. The fuel rank is divided onto three categories: moderate, high, and very high. These results are depicted in Figure 17, the "Fuel Hazard Ranking Map." All fuels, at a minimum, are classified as moderate.

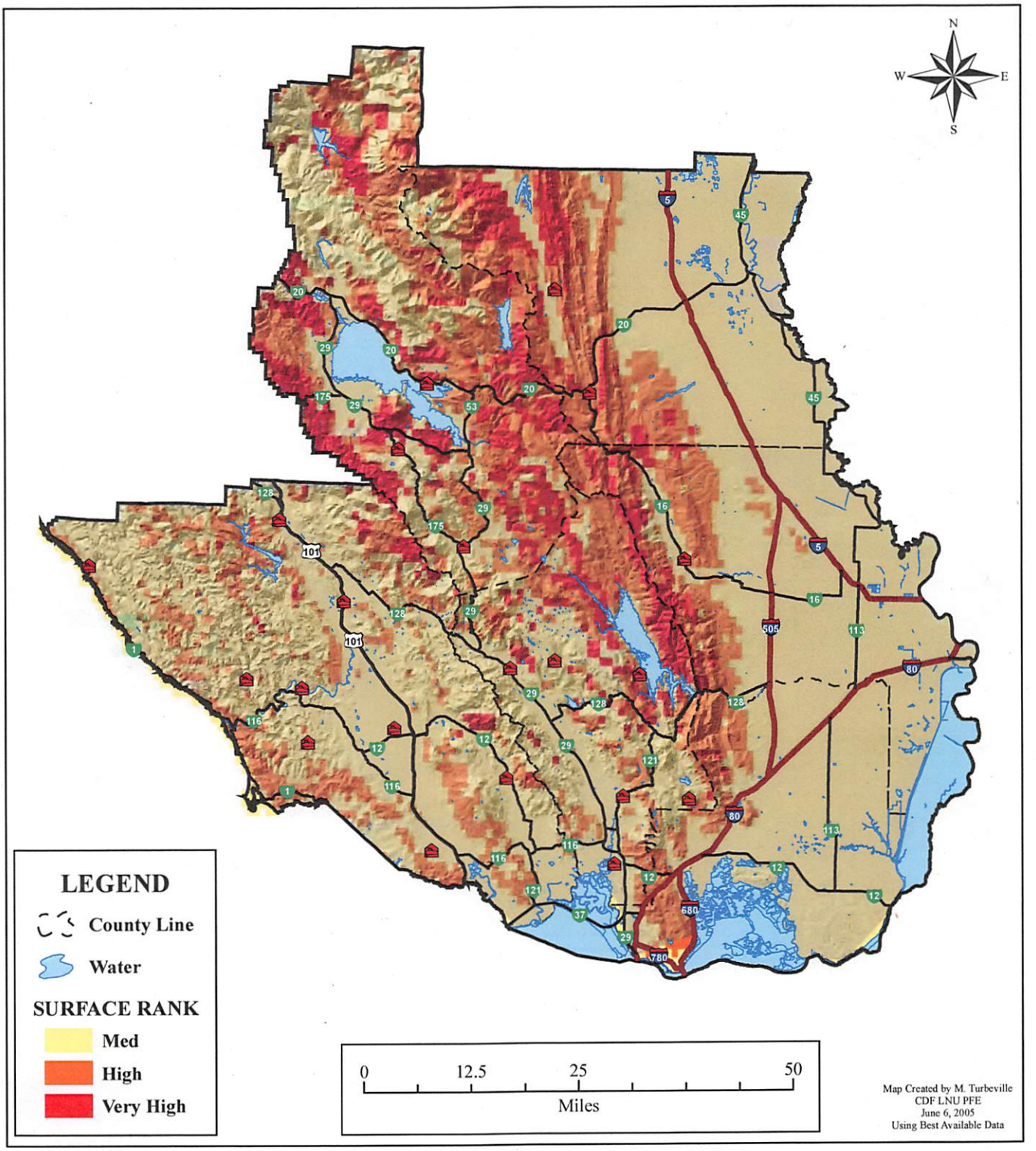


Figure 17: LNU Surface Fuel Ranking

This assessment of wildfire hazard, when combined with the previously described assessment of assets at risk, provide a basis for prioritizing areas for treatment and other forms of pre-fire management. Using this map as a guide, knowledge of fire behavior can be applied to develop pre-fire prescriptions for specific vegetation types and situations. For instance, a community in grass vegetation type may be protected by an annual mowing regimen along roadsides. A brush land community may require a series of prescribed burns implemented systematically, over time, to reduce fuel loads. And a community in the timber type may benefit from a strategic system of shaded fuel breaks. A combination of the aforementioned may be needed in a community that has more than one fuel type. In fact, all of these pre-fire management tools are employed as part of LNU's fire management plan. (These are described in the Project section of this Plan.)

Another fuel factor that isn't considered in the fuel's assessment is the presence of Sudden Oak Death (SOD). SOD has been detected in four of the six counties in LNU: Sonoma, Napa, Solano, and Lake counties. SOD was first noticed in 1995 in the counties of Marin and Santa Cruz, and has caused the death of several species of trees at a landscape level.

Photo 13: Aerial View of Sudden Oak Death in Battalion 1411. April 30th, 2005

SOD is a forest disease caused by the plant pathogen *Phytophthora ramorum*. This pathogen has caused widespread dieback of tanoak and several oak species (coast live oak, California black oak, Shreve's oak, and canyon live oak) in

California's central and northern coastal counties. It has also been found to infect the leaves and twigs of numerous other plants species. While many of these foliar hosts, such as California bay laurel and *Rhododendron* species, do not die from the disease, they do play a key role in the spread of *P. ramorum,* acting as breeding ground for innoculum, which may then be spread through wind-driven rain, water, plant material, or human activity. *P. ramorum* thrives in cool, wet climates. [9]

This gross dieback of native vegetation at such a large level with no solution in sight, will increase the fuel loading available to burn and dramatically increase fire behavior. Because the disease also weakens the trees, there is an increased danger to firefighters working under or near them.

E. Structure Fuels

One incomplete aspect of the previously discussed vegetative wildfire fuels analysis is the consideration of structures located within the wildland areas. To a wildfire, a structure is *just* another fuel. And as mentioned before, the only element of the three environmental elements that influence the behavior of wildfire that we, as humans, can change is fuel. If a structure is in the planning stages, design and construction material recommendations can be made to make the structure less prone to be ignited by a wildfire. However, if the structure is already built, the easiest factor to change may be to implement various fuel modifications around the structures in order to protect them form encroaching wildfires. Public Resources Code (PRC) 4291 addresses fuel modification and the concept of "defensible space." Defensible space can both be thought of for protecting a structure and also providing firefighters with a safe environment to position their fire apparatus and perform the necessary function to prevent the structure from igniting. Unfortunately, the proper building construction and defensible space cannot guarantee that the structure will survive all wildfire possibilities.

Photo 14: Structures Destroyed by Wildfire During 2004 Fire Season

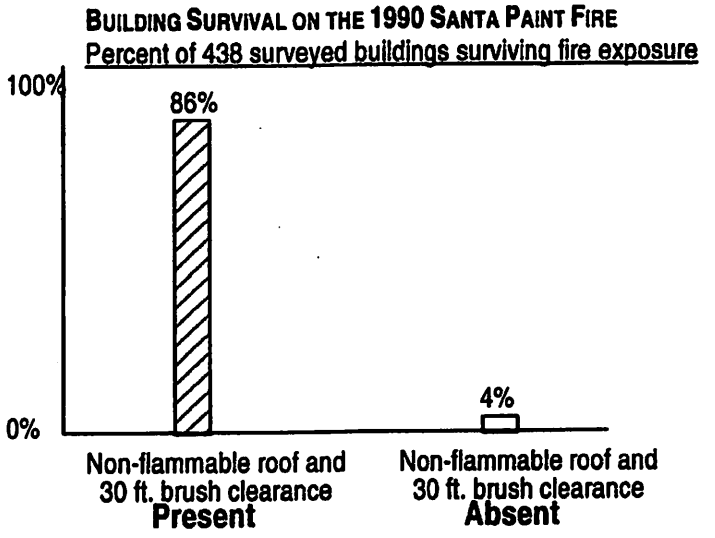
The following excerpt is from a paper prepared by CDF Battalion Chief Ethan Foote, who is assigned to CDF's Northern Region office in Santa Rosa. Besides writing

[9] California Oak Mortality Task Force website. Accessed June 10th, 2005.

this paper, he was the principal researcher on the study of the Paint fire that is mentioned in this excerpt.

"One of the major objectives of wildfire control in general, and pre-fire management hazard reduction in particular, is to reduce the loss of life and property. The historical pattern of building loss during interface fires indicates that vegetation fuel management must go hand-in-glove with ignition resistant building construction to maximize the effectiveness of fire loss mitigation measures.

Building loss and survival on the 1961 Bel Air fire, which destroyed 505 houses, was well documented. The report "Decision Analysis of Fire Protection Strategy for the Santa Monica Mountains" found that 71% of the buildings with 26-50 feet of brush clearance survived the fire. However, the survival rate of buildings exposed to the fire increased to 95% for houses that had both brush clearance and ignition resistant building construction (in this case non-wood roof covering). A similar pattern was seen on the 1990 Santa Barbara Paint fire, shown graphically below.



On the Paint Fire, which destroyed 479 houses and major buildings, the survival rate (above) was 86% for houses with both non-flammable roofing and 30 feet of brush clearance. Only 4% of the 438 houses surveyed in the Paint Fire survived where non-flammable roofing and 30 feet of brush clearance were absent. The modeling of structure loss and survival on the Paint Fire revealed that brush clearance alone only "explained" or accounted for 11% of the variation seen in the structure survival patterns. When brush clearance was combined with roof type in

the model, and the effect of defensive actions was accounted for, the model explained 59% of the variability in structure loss.

This is strong evidence that vegetation management *alone* will not be able to fully explain, nor mitigate, building loss on wildfires. Hence the need for the comprehensive approach in this plan, using a combination of vegetation management and addressing recommendation for ignition resistant building construction. There is also strong evidence that this comprehensive approach will work to significantly reduce interface losses. The "Los Angeles Time" (1 April 2004) reporting on the Southern California conflagrations of October 2003 clearly revealed the need for, and effectiveness of, combining vegetation management and ignition resistant building construction for reducing building loss in wildfires:

> "Amid the ashes of the mostly costly wildfires in California's history lies evidence of a crucial lesson: Fire-resistant construction and vigilant removal of flammable vegetation significantly improved the odds of a home's survival, according to a Times analysis of fire records from more than 2,300 destroyed structures.
>
> The impression left by an out-of-control fire racing through communities can be one of random destruction, with one house, or a whole block, burned to the ground and the next one spared for no apparent reason.
>
> In fact, according to the Times analysis – which covered homes destroyed by the deadliest of the blazes, San Diego County's Cedar Fire – houses built since 1990 were far less likely to burn than those constructed in any previous decade. Houses built during the 1990s were damaged or destroyed at less than half the rate of houses built earlier."

The communities and homeowners covered by this plan have, for the past 40 years, had recommendations that can be (and have been) taken to reduce the ignitability of structures. An outcome of the 1961 Bel Air fire was the publication of the "Fire Safety Guides for California Watersheds" by the County Supervisors Association of California in 1965. These recommendations have been updated through the years. The current version of these "Fire Safe Guides" is "Structural Fire Prevention Field Guide for Mitigation of Wildfires" and can be found at Http://osfm.fire.ca.gov/structural.html.

These recommendations for ignition resistant building construction include:

- Roofing
- Eaves & Balconies
- Exterior Walls
- Rafters
- Windows
- Doors
- Attic Ventilation Openings
- Underfloor Areas
- Decking

In response to the persistent loss of life and property in wildfires the most important of the recommendations is now a requirement. All new buildings, and significant re-roofing of existing buildings, in the communities covered by this plan are required to have ignition resistant roofing (California Building Code § 1503). The State of California is also in the process of promulgating changes to the state building code expanding the interface roof requirements and including new requirements addressing exterior wall construction, vents, and ancillary structures."

At the time of the writing of this Plan, CDF is engaged in creating updated and more accurate maps to depict fire hazard ranking areas. The previous map that is still being used was produced nearly 20 years ago and was based upon personal observation rather than using a modeling program such as what GIS can provide using inputs including fuel models and slope classes. Sonoma and Calaveras were chosen as the two initial test counties for a mapping project that will eventually be completed statewide. Future building codes will reference these maps with the intent that structures will be modified based upon what hazard zone it will be built in. For example, a proposed structure in a medium hazard zone wouldn't need as much construction mitigation as the same structure in very high hazard zone.

Figure 18 was produced to depict the concentrations of structures in the Unit. County parcel data was used, and rankings are done using the Q81st defined areas. The colors represent different housing density classes as described in the table below. The term unit is utilized instead of structures because "large" structures such as multi-family dwelling or condominium are considered to have more units per parcel than using "houses."

Density Class	Housing Density
Very High	Over 1 unit per 5 acres
High	1 unit per 20 acres to 1 unit per 5 acres
Medium	1 unit per 160 acres to 1 unit per 20 acres
Low	Less than 1 unit per 160 acres
Not Ranked	Not Populated (e.g. wilderness areas)

Table 5: Description of Housing Density Classes

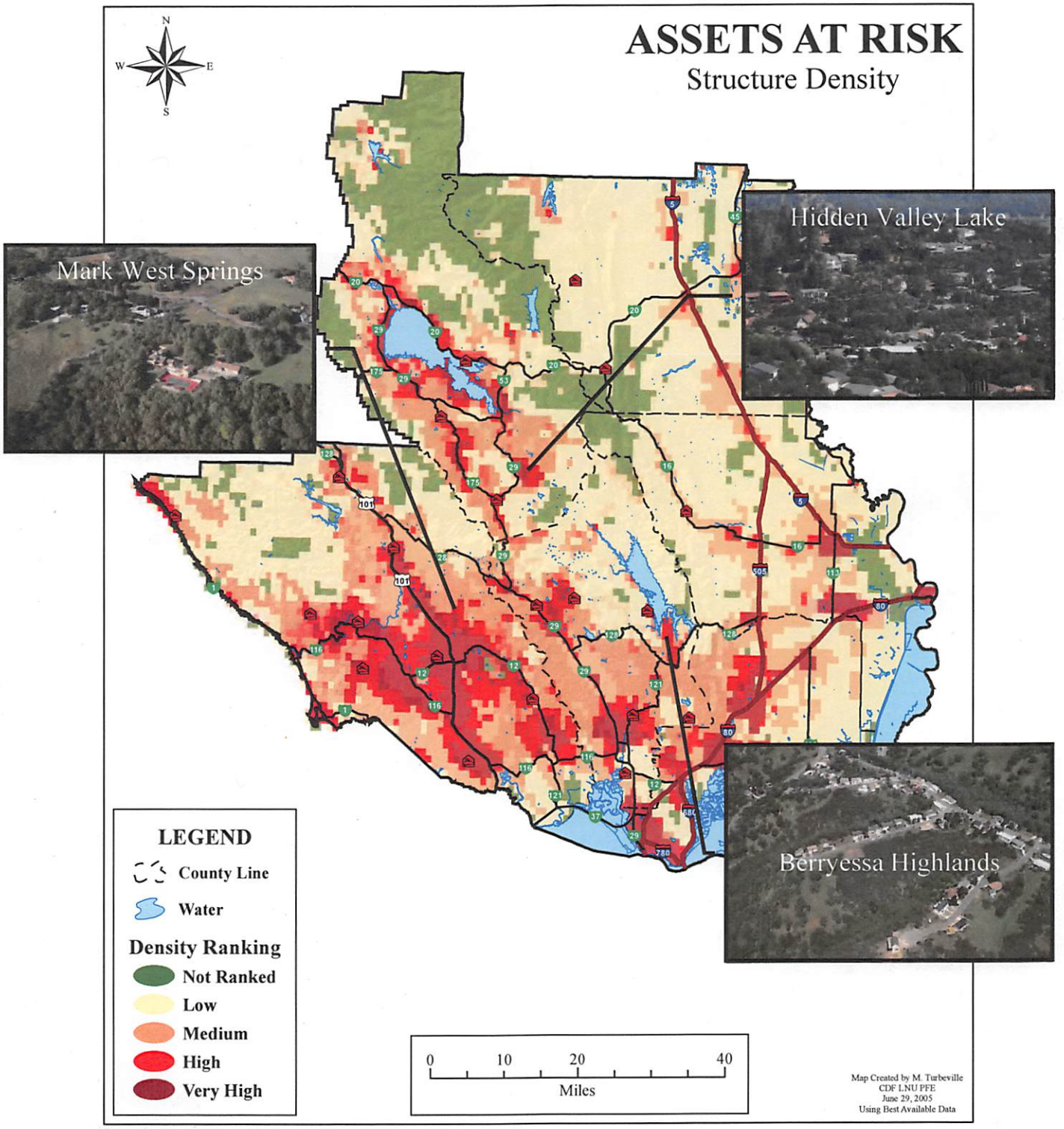


Figure 18: LNU Structure Density Ranking

Besides what was mentioned in Foote's excerpt, there are other considerations outside of what PRC 4291 encompasses. Some of these considerations are included in local "firesafe" ordinances at the county level such as access, water supply, and addressing. Access refers to the road surface, width, grade, and pullouts to allow passing. Water supply describes on-site water storage and delivery systems. Addressing specifies signing standards in order to locate a structure. These additional considerations are inspected when the structure is built, and it is the structure owner/occupant's responsibility to maintain the road, water supply, and address. Too often this maintenance isn't performed.

Photo 15: Wildland Urban Interface Photos

And still yet are other hinderers to firefighting such as locked gates, inadequately constructed bridges, roads blocked by vehicles, heavy accumulation of vegetation along road, and bad addresses provided by 9-1-1 operators.

Photo 16: Wildland Urban Concerns

CDF uses an internal form referred to as "LE-38" for Law Enforcement form number 38 to complete PRC 4291 defensible space inspections. Common terminology for CDF personnel is "LE-38 inspections" or "defensible space" inspections.

Additional information regarding defensible space, PRC 4291, and local ordinances is available at CDF fire stations, and CDF's website (www.fire.ca.gov). An example of available literature is shown on the following page.

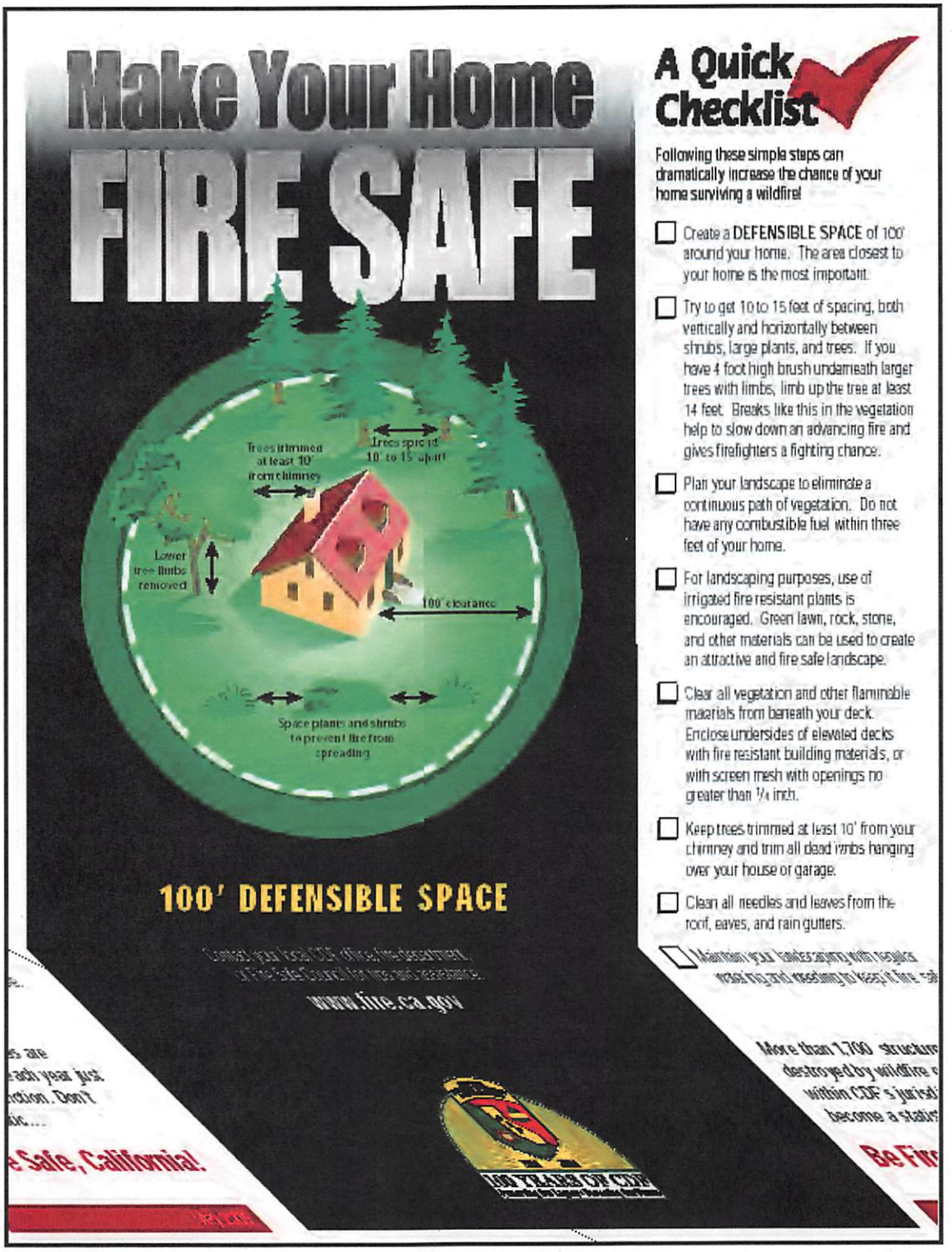


Figure 19: Example of Material Available on CDF Website

F. Frequency of Severe Fire Weather

Fire behavior is dramatically influenced by weather conditions. Large, costly fires are frequently, though not always, associated with severe fire weather. Severe fire weather is typified by high temperatures, low relative humidity, and strong surface winds. The State fire plan weather assessment considers the different climates in California. There are also various different climates in LNU. The Pacific Ocean to the west and the San Francisco Bay to the south greatly affect the Unit weather, as does the eastern edge of the Unit being the western edge of the Sacramento Valley. Each of these local climates experiences a different frequency of weather events that lead to severe fire behavior as a result of the weather.

It is easy to state that high temperatures, low relative humidity, and strong winds contribute to extreme fire behavior, but it is difficult to quantify each of them and even more difficult to realize the effects each weather factor has on each other. The state fire plan's weather assessment uses a Fire Weather Index (FWI) that was developed by researches at the USDA Forest Service's Riverside Fire Laboratory. This index combines air temperature, relative humidity, and wind speed into a single value "relative" index. Refer to Figure 20 for the formula.

$$FWI = \eta \sqrt{\frac{1 + U^2}{0.3002}}$$

Where: U = wind speed (miles per hour)

$$\eta = \left(\frac{m}{30}\right) + 1.5\left(\frac{m}{30}\right)^2 - 0.5\left(\frac{m}{30}\right)^3$$

Where: m = equilibrium moisture content and is a function of temperature in degrees Fahrenheit (T) and relative humidity (h) in percent

For h less than 10%: $m = 0.03229 + 0.281073h - 0.000578hT$

For h from 10 – 50%: $m = 2.22749 + 0.160107h - 0.01478T$

For h greater than 50%: $m = 21.0606 + 0.005565h^2 - 0.00035hT - 0.483199h$

Figure 20: Fire Weather Index Formula

Corresponding fire behavior with each FWI values is described in the following table.

FWI Value	Adjective	Description
0 - 5	Very Low	Fires are not likely to start. If started, they spread very slowly or may go out. There is little flaming combustion and generally only the upper portion of the litter is consumed. Control is readily achieved and little or no mop-up is required.
6 – 10	Low	Ignition may take place near prolonged heat sources. Spread is slow in forests, and moderate in open areas. These are light surface fires with low flames; generally, the litter layer is consumed. Control is readily achieved, and some light mop-up will be required.
11 – 15	Moderate	Flaming matches may start fires. Spread is moderate in forests, fast in open areas. Fires burn on the surface with moderate flames, Some of the duff may be consumed on dry sites. Control is not difficult and light to moderate mop-up will be necessary.
16 – 20	High	Flaming matches will probably start fires. Spread may be fast in the forest, though not for sustained periods. These are hot surface fires with some individual tree crowns being consumed. Short range spotting may occur. Much of the diff will be consumed on shallow and dry sites. Control may be difficult, and mop-up will require a moderate effort.
21 – 30	Very High	Ignition can occur readily. Spread will be fast for sustained periods. Fires may be very hot, with local crowning and medium range spotting. Much of the duff will be consumed on moderately deep and normally moist sites. Control will be difficult and mop-up may require an extended effort.
31+	Extreme	Ignition can occur from sparks. Rates of spread will be extremely fast for extended periods. Fires will be very hot, and there may be extensive crowning and long range spotting. Much of the duff will be consumed on deep and normally wet sites. Control may not be possible during the day and mop-up will be difficult and extensive.

Table 6: Fire Weather Index Value and Corresponding Fire Behavior

This index is calculated from ten years of hourly weather readings (COUNTWX) collected at remote activated weather stations (RAWS). The FWI doesn't include fuel factors such as fuel type or fuel moisture, nor does it consider topography other than the topographic features that affect the weather station data collection. Each weather station is assigned a representative weather region. Table 7 describes the RAWS in LNU.

Station	ID	WIMS ID	Owner	Latitude	Longitude	Elevation (feet)
Alder Springs	ADS	041101	USFS	N 39.650	W 122.725	4500
Booneville	BNV	041001	CDF MEU	N 38.950	W 123.340	840
Brooks	BSS	042202	CDF LNU	N 38.718	W 122.135	360
County Line	CYL	041410	BLM	N 39.019	W 122.412	2085
Eel River	EEL	041005	USFS	N 39.825	W 123.083	1500
Knoxville Creek	KNO	041409	BLM	N 38.883	W 122.417	2200
Konocti	KNC	041411	CDF LNU	N 38.917	W 122.717	2100
Lyons Valley	LYO	041408	BLM	N 39.125	W 123.071	3200
McGuires	MGS	041017	CDF MEU	N 39.336	W 123.601	520
Redding	RED	040611	CDF SHU	N 40.516	W 122.291	502
Sac NWR	SWR	041102		N 39.367	W 122.150	95
Santa Rosa	STA	042009	CDF LNU	N 38.470	W 122.703	600

Table 7: LNU Remote Activated Weather Station (RAWS) Attributes

Photo 17: Sample of Unit's Weather

Every day, throughout the year, RAWS observation data is electronically submitted to an electronic national database. Air temperature, relative humidity, and wind speed are extracted from this database to calculate the fire plan's FWI. These collected values are inputted into the FWI formula and compared to a "threshold" FWI value that is derived from average "bad" fire weather conditions of 95°F, 20% relative humidity, and a wind speed of seven miles per hour (MPH) at eye level. This equates to a FWI value of 29.725, and any value above it is considered "severe."

The frequency of severe fire weather is defined as the percentage of time during the budgeted fire season[10] that the representative weather stations recorded observations (WXINSEAS) that when computed equate to, or are greater than 29.725. Non-fire season data is not considered, as the fuels are not in a state in which they readily burn regardless of the severity of weather. Naturally, there are rare exceptions to this; however it is not feasible to factor in all possible contingencies. Moreover, including this data would only serve to weaken the representative impact that severe weather plays in fire behavior.

Since each station may have a different amount of observation then another, a ratio between the number of "severe" observations (SEVEREWX) and the total number of observations (WXINSEAS) needs to be calculated for the purposes of comparison between stations. This ratio or percent is WXSCORE. Ranking is based upon the WXSCORE with values from 0 – 5 classified as low, 5 – 20 as medium, and values greater than 20 as high. Correspondingly, the region represented by the weather station is given the same attribute ranking. Table 8 shows the values for LNU's RAWS, and Figure 21 is a map depicting the geographic areas assigned to each RAWS and the corresponding ranking.

Station	Total Observations (COUNTWX)	Fire Season Observations (WXINSEAS)	Number of "Severe" Observations (SEVEREWX)	Percent of Severe Observations (WXSCORE)	Rank (WXRANK)
Alder Springs	75,523	32,918	249	0.76	Low
Booneville	66,039	29,273	288	0.98	Low
Brooks	67,379	38,062	241	0.63	Low
County Line	56,879	31,921	3011	9.43	Medium
Eel River	89,120	38,883	478	1.23	Low
Knoxville Creek	71,140	38,908	2,244	5.77	Medium
Konocti	68,383	40,405	1,750	4.33	Low
Lyons Valley	66,045	29,339	6,773	23.09	High
McGuires	70,302	31,538	15	0.05	Low
Redding	15,965	7,302	768	10.52	Medium
Sac NWR	16,557	7,228	326	4.51	Low
Santa Rosa	35,360	21,558	208	0.96	Low

Table 8: Fire Weather Index Calculation Inputs

[10] Budgeted fire season refers to a defined period of time when CDF expects that some, but not all, of its' fire protection resources will be needed on a daily basis for the suppression of wildfire. Because LNU was two separate units that were merged in 1996, there are two different budgeted fire seasons.

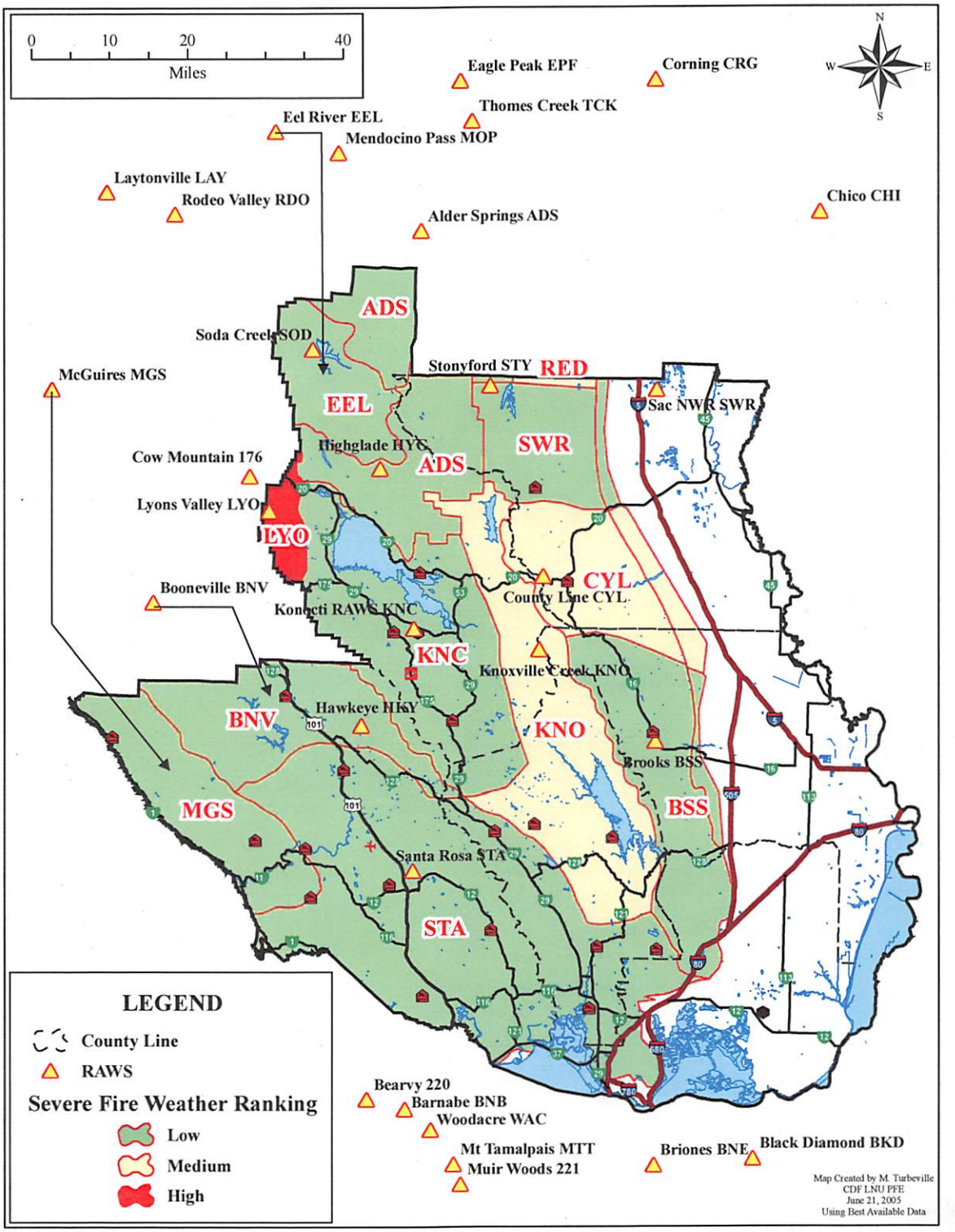


Figure 21: Initial Severe Fire Weather Index Ranking

Unfortunately, statewide there are many voids in RAWS and other weather station data, either because data has not been documented over time, or because the nearest default weather stations are not truly representative of local weather conditions. This latter condition is particularly acute in the southern end of LNU, where fire weather conditions are extremely variable over relative short geographic distances due to the attenuation of coastal influences with distance from the Pacific Ocean and the San Francisco Bay.

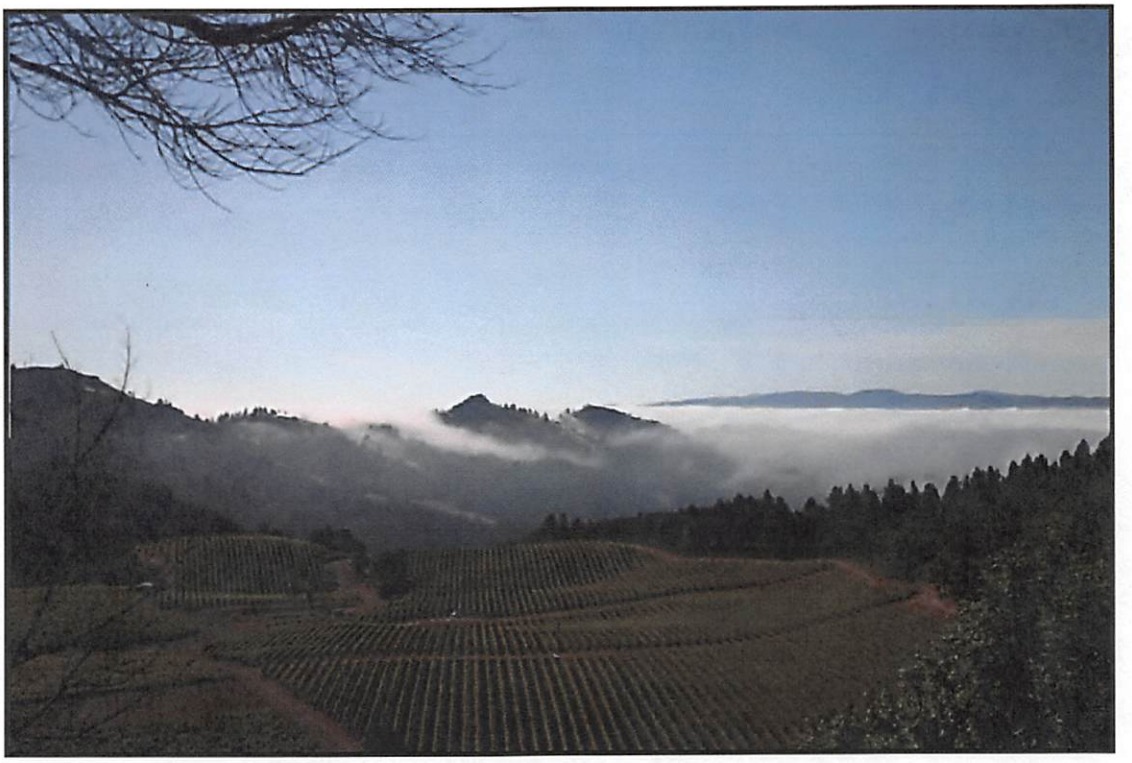


Photo 18: View of Fog Filling western Napa and southern Sonoma County as Viewed from Ida Clayton Road looking south.

In areas where there are insufficient weather stations to adequately represent "true" fire weather conditions; the system frequently defaults to using data from weather stations that do no accurately reflect local site-specific conditions. Thus, for example, the Napa Valley and the southern Sonoma County coastline default to the same weather station located in the City of Santa Rosa, despite vast differences in fire weather. On an August afternoon, it is not uncommon for it to be sixty degrees and foggy along the coast, and over one hundred degrees in the Napa Valley, yet for the purposes of determining initial attack success or failure, fires in both locations are presumed to burn with similar intensity and require the same amount of effort to contain.

Another concern is the use of RAWS location outside of the boundaries of LNU such as Eel River and McGuires and the non-use of other RAWS that are in the Unit such as Hawkeye and High Glade. RAWS selection and the area each represent needs to be addressed to bring validity to the FWI analysis. If may be more beneficial to use RAWS

located in Marin County after they become established, calibrated, and their data accepted as being accurate.

Until new or alternative sources of weather station data can be made available, the Unit will rely on observed fire behavior along with fire history data as the best available approximation of severe fire weather. It has been noted that certain areas are prone to wildfire again and again. These "historic wildfire corridors" occur where topography, fuels, and weather combine to channel large and damaging fires in particular locations. (Refer to the Local Fire Problem section of this Plan for further discussion and figure on this topic.) Therefore, as the validation step of the FWI, the low, medium, and high rankings will be modified to correspond with these two factors: observed fire behavior, and fire history data. These changes are reflected in Figure 22 on the following page.

LNU has ordered an additional RAWS that will be delivered during the 2005 Fire Season. This station will most probably be set up to better represent southern Napa County.

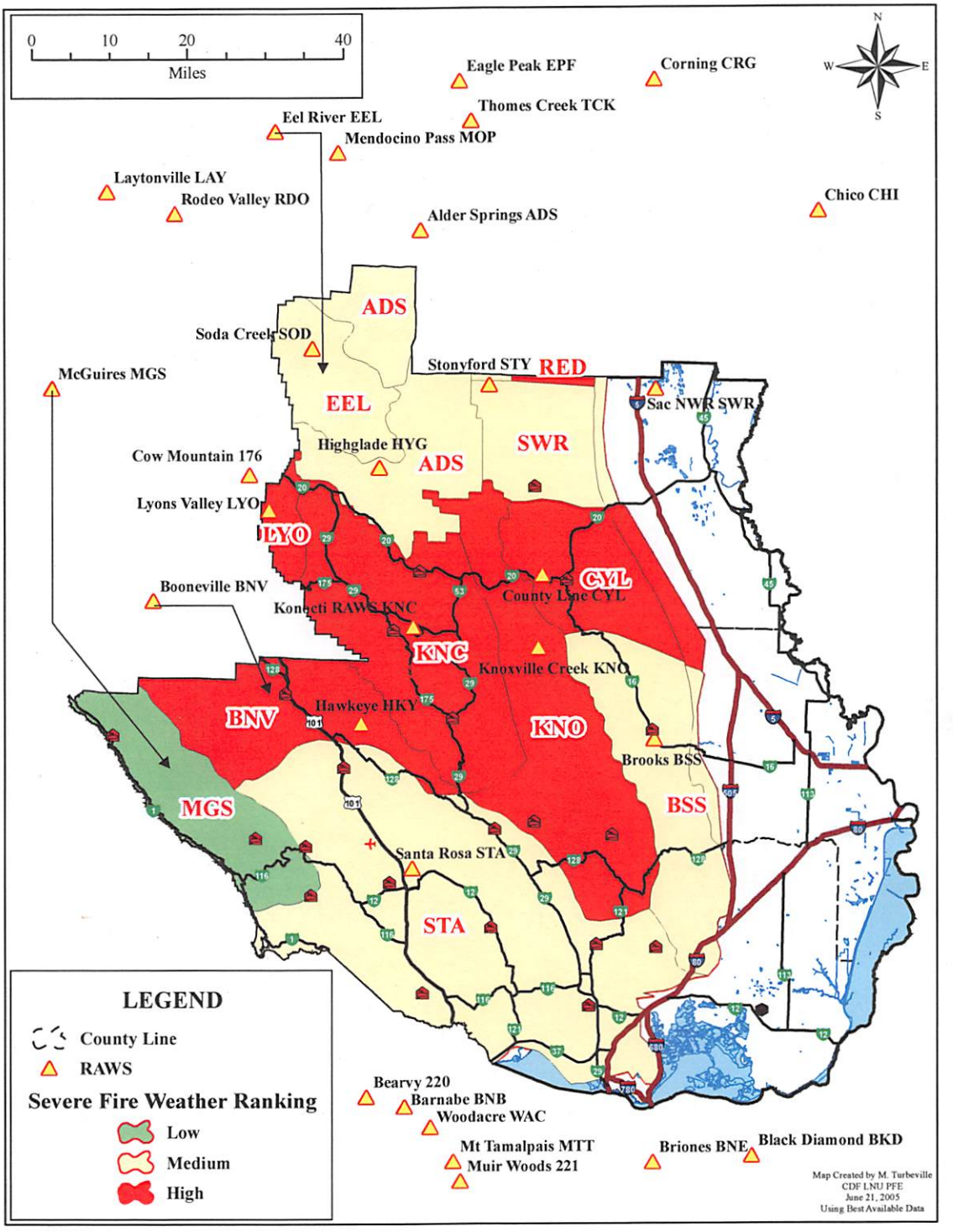


Figure 22: Final FWI Ranking with RAWS Locations

VIII. PROJECTS

This portion of the Plan elaborates on projects, or what has been done "on the ground" prior to a wildfire to mitigate the loss from large and damaging wildfires. Projects are classified by battalions since the battalion level is the lowest field level supervisor. There are ten field battalions in the Sonoma-Lake-Napa Unit (LNU) as illustrated in the figure below.

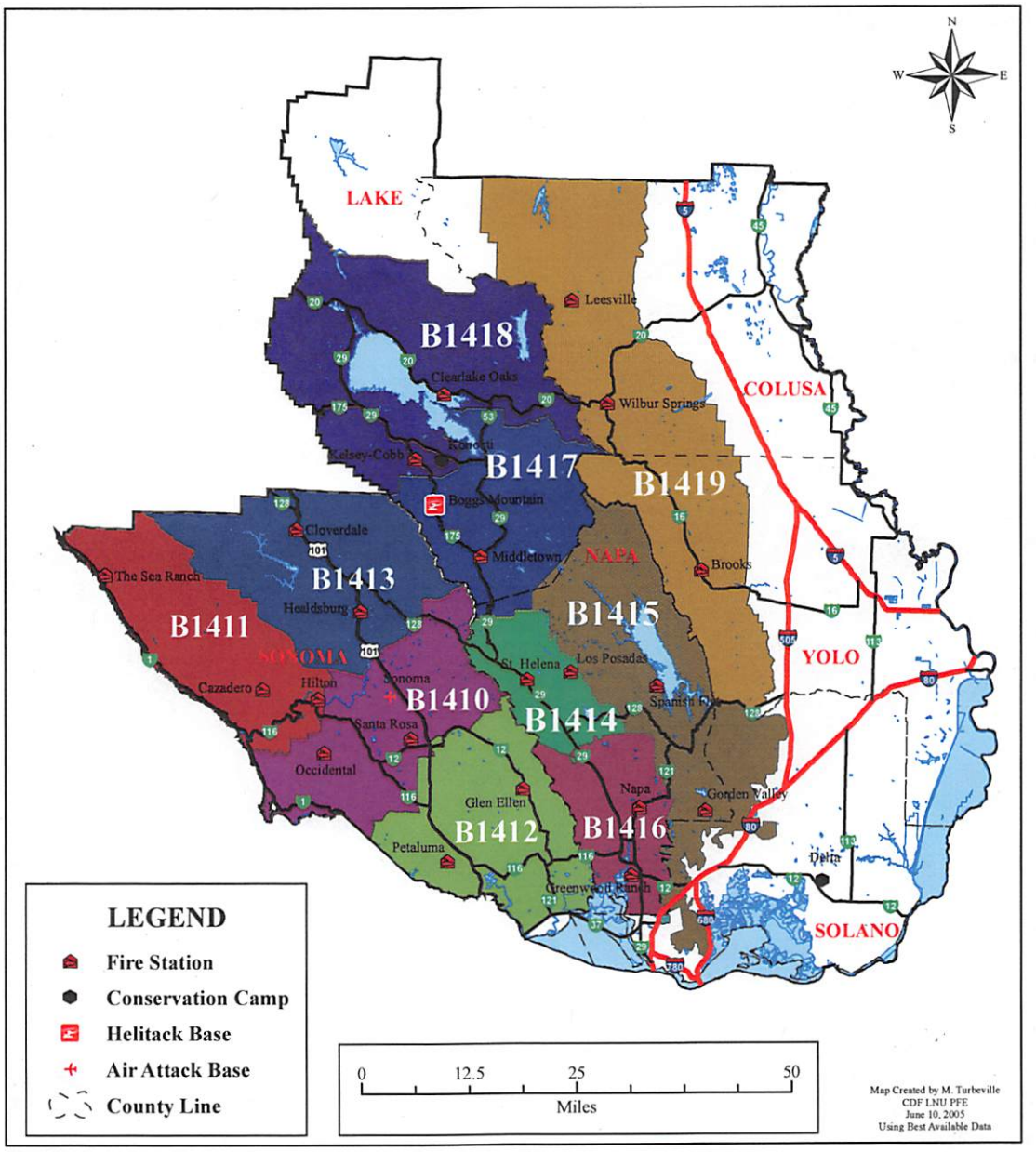


Figure 23: LNU Field Battalions

A. Battalion 1410 (Mike Mickelson)

Battalion 1410 spans from the Pacific Ocean to the top of Mt. Saint Helena running the width of Sonoma County, and an elevation difference of over 4,300 feet. The battalion is characterized by a LRA valley floor, the Santa Rosa plain, with SRA on both sides. There are many paid local government fire departments and the largest city in the Unit, Santa Rosa, is located within the battalion. There are three CDF fire engines, one at the Santa Rosa station and two at Occidental.

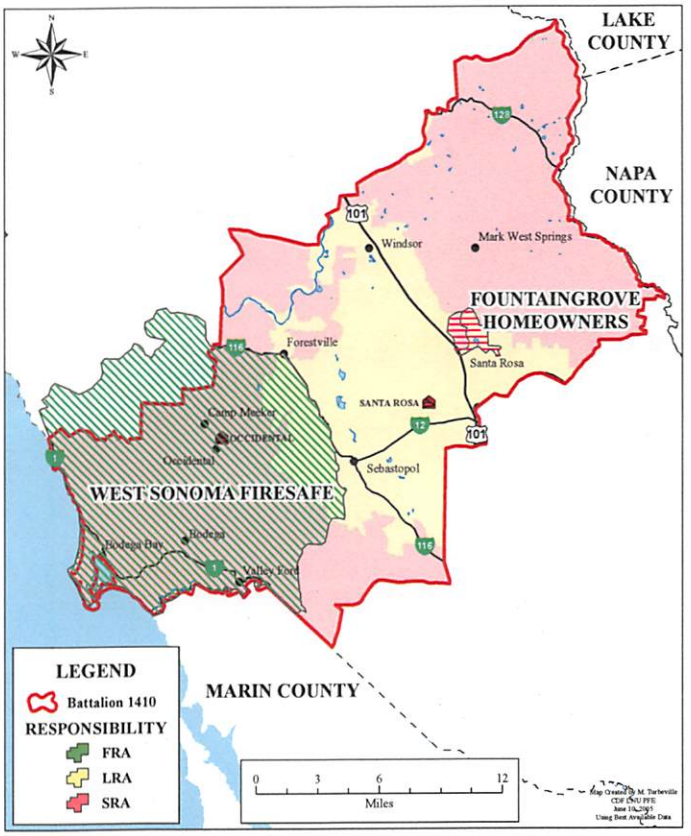


Figure 23: Battalion 1410

Every incident becomes multi-agency and often with structures being threatened. The perimeter of the 1964 Hanley fire when placed over the footprint of Santa Rosa City and the adjacent area encompasses over 1,000 structures.

Battalion Chief Mike Mickelson transferred into the battalion effective June 6th, 2005 following the retirement of Mike Foley.

1) Past Projects

In June of 2003, the West Sonoma Firesafe Council obtained a $28,000 BLM Community Based Wildfire Prevention Program Grant. This Grant helped to solidify the formation of the Council and to address fuel reduction in the rural area of western Sonoma County surrounding the community of

Photo 19: Coleman Valley Shaded Fuelbreak

Occidental. The Council used the grant to provide a "free" chipper with operator to residents who cleared vegetation around their residence, a demonstration shaded fuelbreak along Coleman Valley Road, (Photo 19) and a community presentation by a fire ecologist. Chipping was done along Joy Road. (The Council area is defined by watersheds and Highway 116, and thus a portion of the Council is in Battalion 1411.)

Chief Foley had worked with the Foothill Homeowners' Association to help them understand the risk of fire and the importance of defensible space. He also advised them on areas for fuels reduction and evacuation advice.

The Fountaingrove Homeowners' Associations I and II held meetings with Chief Foley to address their concerns with wildfire. CDF responds to fires in the Fountaingrove area under a mutual threat zone (MTZ) agreement. The area is located adjacent to SRA, and has a high potential for significant dollar loss.

Photo 20: Example of the Urban Interface within and adjacent to the City of Santa Rosa

The City of Santa Rosa fire department published a fuel reduction plan for the wildland immediately adjacent to the city limits including Annadel State Park. The consultant focused on classifying the fuels and then recommending specific treatment methods. The treatments were then prioritized. It is to be seen if the City can follow through on any fuel reduction as proposed in the plan. There is the potential for the City to work with CDF to accomplish some of the fuel reduction.

2) Current Projects

There are no current projects in the West Sonoma Firesafe Council area. The Council was denied on their last grant request. FireSafe Sonoma, which encompasses the entire county, continues to hold meetings and work in support of projects.

Battalion 1410 personnel will work with the Rincon Valley Fire Protection District to complete LE-38 defensible space inspection in the rural area east of Santa Rosa near Calistoga Road during the 2005 fire season.

3) Future Projects and Priority Rankings

With the change in battalion chief, there are no proposed projects. It is anticipated that future projects will focus on areas identified as high risk/high hazard, support the West Sonoma FireSafe Council and the City of Santa Rosa.

B. Battalion 1411 (Deanna Baxman)

Battalion 1411 encompasses the northwestern edge of the Unit, and some of the most rural areas of Sonoma County. All of the battalion is SRA, 236,638 acres, with the exception of a few parcels of FRA in BLM's Austin Creek/Cazadero holdings, and the Kashia Indian Reservation. Russian River Fire Protection District is the only paid local government fire department, except for a CDF Schedule A program at The Sea Ranch. There are four CDF fire engines in the battalion, one at The Sea Ranch, another near the small community of Cazadero, and two just east of Rio Nido along Highway 116 at Hilton.

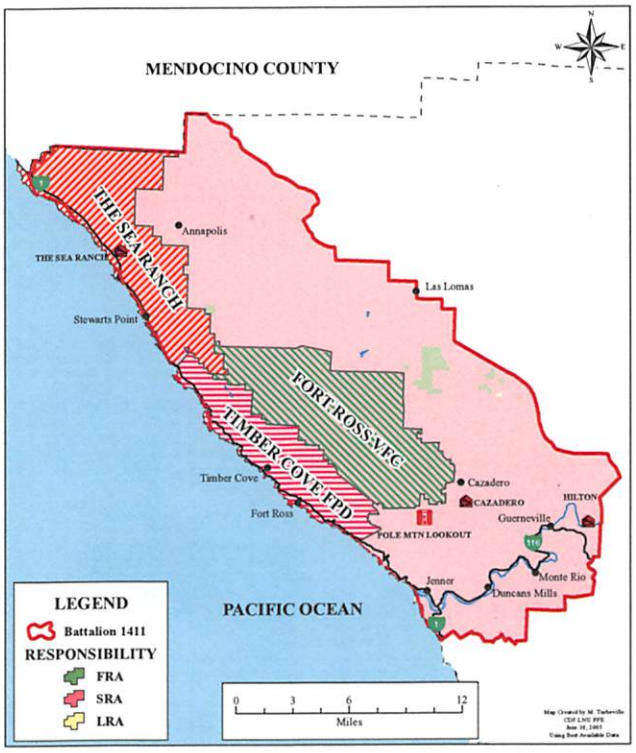


Figure 24: Battalion 1411

One of the previously mentioned wildfire corridors is located in Battalion 1411, along Highway 116, and the residents of the battalion are very aware of risk of wildfire. The Creighton Ridge fire of 1978 hasn't been forgotten.

Unique to the battalion is The Sea Ranch and Pole Mountain Lookout. The Sea Ranch was created in the late 1970s with the acquisition of 3,500 acres of land that was used as a sheep ranch. The result is a 2,300-parcel subdivision that has a well-organized association, The Sea Ranch Association (TSRA) that is very aware of the wildfire hazard. Pole Mountain Lookout is a privately funded lookout, possibly the only of its' kind in the state, with funds being raised from local communities. Pole Mountain is staffed daily throughout the fire season and is instrumental in the detection of local fires and provides weather observations.

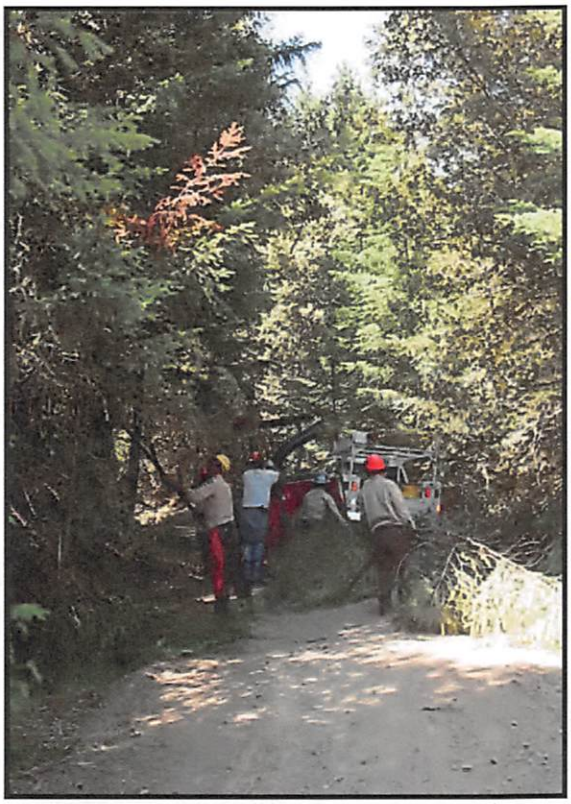
1) Past Projects

Since 1983, the Unit has had a series of VMP projects in The Sea Ranch Area. CDF staff worked with the TSRA in development of their Fire Management Plan in 1990. Since that plan was adopted, the wildland-urban interface fire problem has evolved with the construction of more homes, an increase in understory fuels, the invasion of

grasslands by shrub species, and a decline in the health of non-native pine trees. TSRAhired a consultant and using their own Association funds have begun to implement fuel reduction projects. Emphasis is placed on the lands adjacent and grasslands west of Highway 1.

Photo 21: Ruoff Road Two Years After Shaded Fuelbreak Established

In the Timber Cove area, a fuel reduction project funded by BLM through the Community Based Wildfire Prevention Grants Program created a shaded fuelbreak along Ruoff Road between Highway 1 and Timber Cove Road. Ruoff Road transects an area of timbered wildland that has been developed. The road provides access to many homes, and was not passable to two-way traffic in many locations because of the narrow paving and encroaching vegetation. The fuelbreak will provide for evacuation, access for firefighting resources, and a possible "line" to halt a fire. The grant was sponsored through Fire Safe Sonoma, with staff support provided by CDF and the Sonoma County Department of Emergency Services.



The Fort Ross Volunteer Fire Company has been active in the reduction of fuel loading through coordinated chipping and formation of shaded fuelbreaks, through the same funding mechanism and administration as the Timber Cove area. A California Conservation Corps (CCC) crew was used in place of a private contractor to compete the work. The CCC crew worked with the residents to clear and chip several shaded fuelbreaks.

Photo 22: CCC Crew Working on one of Fort Ross Volunteer Fire Company's Shaded Fuelbreaks

2) Present Projects

The TSRA last updated their fire plan in November of 2002, and a currently working on updating it again. All funding is through a parcel assessment fee. Annually, the TSRA still coordinates fuel reduction through the use of mowing and grazing. CDF personnel assigned to The Sea Ranch fire station aggressively completes 500 to 1,600 LE-38 defensible space inspections each year.

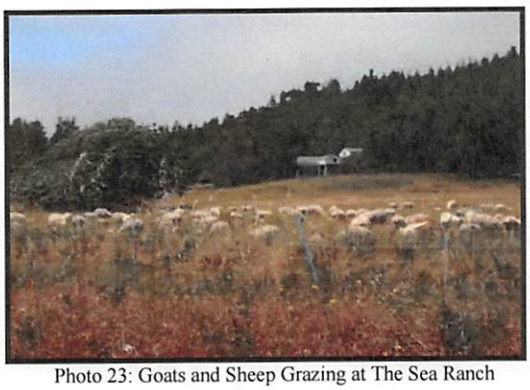


Photo 23: Goats and Sheep Grazing at The Sea Ranch

Battalion 1411 personnel annually post fire prevention signs along the major roadway corridors, conduct LE-38 defensible space inspections in target areas, maintain a presence at large community events, and participate in many other forms of public education.

Battalion Chief Baxman conducts powerline and pole inspections annually in her battalion. She is also aware of several California Forest Improvement Program (CFIP) projects within her battalion but has very little involvement in their administration since the projects are coordinated at CDF's Northern Region office.

3) Future Projects and Priority Rankings

The Fort Ross Volunteer Fire Company has submitted another BLM grant for chipping of roadside vegetation along major corridors to create additional shaded fuelbreaks, distributing publications to inform residents about defensible space, funding for address signs, and providing a chipper for private driveways and areas adjacent to structures. A long-term goal is to create a regional CWPP.

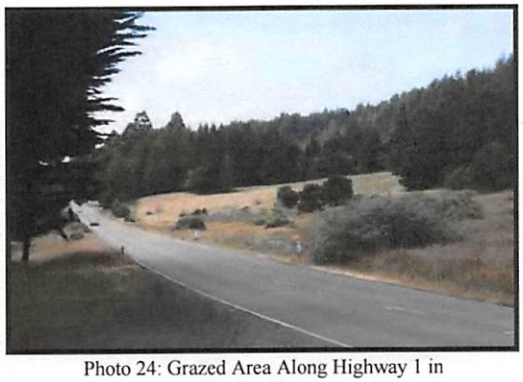


Photo 24: Grazed Area Along Highway 1 in The Sea Ranch

Since the TSRA already has a well-established fuel reduction program, the possibility exists to expand it using grant monies. The Association has not explored this option, but has always relied upon funding through a parcel assessment.

Battalion 1411's priorities are to support the Fort Ross Volunteer Fire Company, whom have been included in this Plan, The Sea Ranch Association, and any other groups that actively bring forward projects to CDF.

C. Battalion 1412 (Roy Sprague)

Battalion 1412 encompasses southern Sonoma County; the Sonoma Valley and the Petaluma area, separated by Sonoma Mountain. Within the battalion are several full-time local government fire departments as well as volunteer based fire departments. There are two CDF fire stations, one just west of Petaluma staffed with one fire engine, and the other along Highway 12 south of Kenwood that houses two fire engines and a bulldozer.

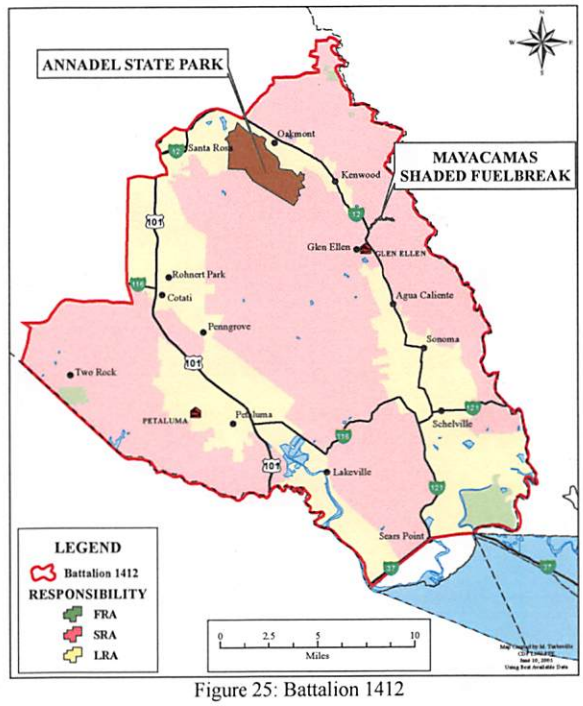


Figure 25: Battalion 1412

1) Past Projects

Past projects have been funded through BLM's Community Based Wildfire Prevention Grants Program using a variety of methods to get the actual work completed. Near Glen Ellen, a grant was sponsored through FireSafe Sonoma, to establish a safety corridor and a secondary ingress and egress route in a high hazard area adjacent to Annadel State Park. Another project, also sponsored by FireSafe Sonoma used Sonoma County work crews to clear roadways that had been overgrown by vegetation. And along five miles Trinity Road in the Mayacamas Mountains east of Glen Ellen, a shaded fuelbreak was created using CDF Fire Crews, residents, and county work crews. The Trinity Road fuelbreak was funded by the Forest Stewardship, a previous program similar to BLM's Community Based Wildfire Prevention Grant Program.

2) Present Projects

Present projects consist of small community events such as the one held on May 28th, 2005 for Lovall Valley residents. CDF apparatus and personnel also participate in other community events such as parades.

Each year, CDF commits fire prevention and suppression resources to large events at Infineon Raceway located near Sears Point along Highway 37. The Raceway holds several races during the summer months that attract over 100,000 spectators.

3) Future Projects and Priority Rankings

None are identified at the time of publication.

D. Battalion 1413 (Kim Thompson)

Northeastern Sonoma County, including the unique Geysers geothermal area, and the United State Army Corps' Lake Sonoma Project, are within Battalion 1413. Most of the battalion is very rural, with only two incorporated cities, Cloverdale and Healdsburg. The burn permit process generates over two hundred public contacts each year, giving Battalion 1413 personnel the opportunity to both educate and inform agricultural industry related personnel and residents about wildfires. The battalion stations are Healdsburg with two engines and a bulldozer, and Cloverdale staffed with two engines.

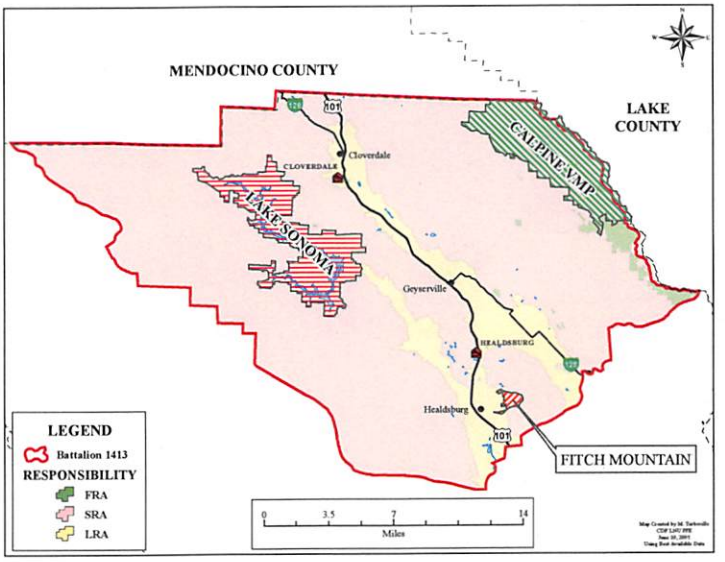


Figure 26: Battalion 1413

1) Past Projects

The battalion has been very busy with pre-fire management programs in the past ranging from vegetation management program (VMP) control burns at the remote Cooley Ranch north of Lake Sonoma to homeowners working with CDF and the local fire department to reduce fuels in the Fitch Mountain Area.

In 2000, the City of Healdsburg Fire Department contacted CDF for advice on its' growing wildland/urban interface fire hazard, particularly on the City's north and east flanks. This area compromises the steepest and highest elevations in the city, on Fitch Mountain, and area adjacent to it, which is SRA. Working with FireSafe Sonoma, Healdsburg Fire Department, and the Sonoma County Department of Emergency Services, a plan was developed for a multi-phase fire environment modification. Funding was secured through a Western Wildland Urban Interface Grant administered by the USDA Forest Service. During the summer of 2001 and 2002, this project was implemented with LE-38 defensible space inspections, a community chipper program, and the re-establishment of an alternative fire access road. California Conservation Corps (CCC) crews were also used.

Also in 2002, approximately 150 acres was burned on the CalPine VMP during with winter months.

In the Palomino Lakes subdivision, CDF and the Cloverdale Fire Protection District coordinated with the Palomino Homeowners' Association to reduce fuel loading. The Palomino Lakes subdivision has experienced damaging fires in the past. Private contractors were used to clear vegetation along roads, and chip over seventy-five cubic yards of vegetation. Along with the work, a community meeting was held.

At the Lake Sonoma Project, a VMP burn was completed in November of 2002 after more than fifteen years of planning. CDF maintains an agreement with the Army Corps for wildland fire protection. Each year under this agreement, a meeting is held to discuss the contract. Part of CDF's responsibility is to train the Army Corps' staff in wildland firefighting, discuss fire prevention issues, and pre-plan emergency response. Much of the lake's campgrounds are remote and access is only via a boat and/or fire roads. CDF fire crews are used to construct precautionary handlines around the campsites prior to fire season, and bulldozers and graders are used to maintain the fire roads on a rotating basis. A fire prevention display is kept at the visitors' center as well as a fire prevention sign and fire danger rating sign along the roadway leading to the lake's main access.

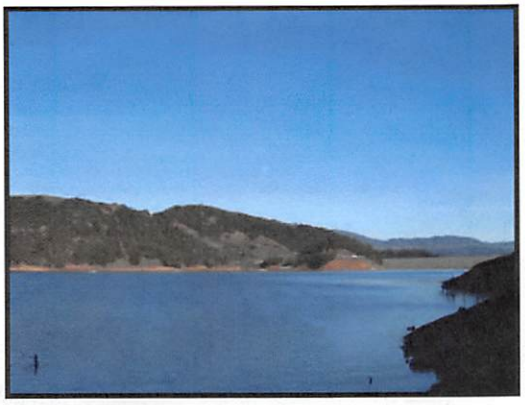


Photo 25: US Army Corps Lake Sonoma Project

Battalion Chief Kim Thompson works closely with local government cooperators, annually holding a multi-agency drill that replicates a wildland-urban interface wildfire response. This event while providing training for CDF and local government personnel increases wildfire awareness and prevention in the community in which the drill is held. The image of a fire engine backed in a driveway, with fire fighters in full personnel protective equipment and fire hoses deployed generates discussion amongst homeowners and CDF. Additional benefits include area orientation and pre-planning for fire fighters, the opportunity for homeowners to approach fire fighters, and for personnel from different fire departments the opportunity to interact.

Battalion 1413 personnel also complete many LE-38 defensible space inspections. Each year a targeted area is defined for each station to complete inspections, using direct mailers asking for volunteer compliance or self-inspection. CDF personnel then complete follow-up work to ensure compliance. This LE-38 approach in conjunction with the aforementioned multi-agency drill bodes well for promoting the concept of defensible space.

2) Present Projects

Working with CalPine, a project is being drafted for VMP burning on the lands they control. Brush species will be targeted with the burning most likely to occur in the fall.

Personnel actively participate in community events, such as the Healdsburg Future Farms of America (FFA) parade held on Memorial Weekend of each year.

Photo 26: Battalion 1413 Fire Apparatus and Personnel in Healdsburg FFA Parade

3) Future Projects and Priority Rankings

In 2004, Assistant Chief Dana Cole, and Battalion Chief Kim Thompson met with CalPine representatives to complete a hazard assessment and provide recommendations regarding defensible space surrounding the many structures in the Geysers Geothermal Area. Collaboration with CalPine personnel is ongoing with additional structures being inspected in 2005.

Upcoming focus will be on the West Dry Creek Road area. BC Thompson is working on a presentation to the Dry Creek Valley Association and this year's multi-agency training will be held in this area. The West Dry Creek Road area has experienced a large damaging fire in 1959, the 2,041 acre Wine Creek Fire, and the 1972 Bradford Fire that burned 1,782 acres. Since then many more homes have been built in the area that was burned. The potential exists for a similar fire to occur under severe fire weather conditions.

E. Battalion 1414 (Mark Barclay)

Battalion 1414 covers northern Napa County from the small community of Rutherford to the top of Mt. St. Helena and east to Angwin. Highway 29 is the major traffic corridor through the battalion. Las Posadas State Forest is within the confines of the battalion, and there is a fire station on the forest property with one fire engine. Other CDF fire resources in the battalion are two CDF fire engines and a bulldozer at St. Helena, and a CDF staffed, county-owned fire engine at St. Helena.

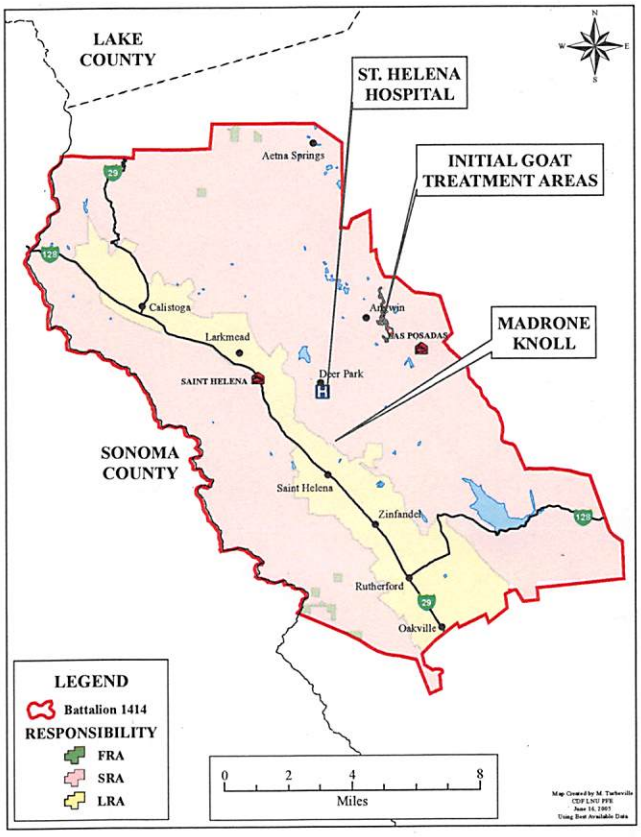


Figure 27: Battalion 1414

Similar to Battalion 1413 personnel, many contacts with the public are generated through the burn permit process. Most of the Napa Valley floor, and some of the hillsides, are planted with grapevines. This industry has a heavy reliance on burning to dispose of agricultural trimmings.

Battalion 1414, as well as battalions 1415 and 1416, oversees Napa County Fire Department volunteer fire companies. Assigned to Battalion 1414 are Deer Park, Angwin, and Rutherford. St. Helena and Calistoga cities also have their own organized fire departments and respond with CDF daily to incidents. All three battalions, except for the portion of Battlion 1415 in Solano County, are included in the Napa FIREWISE program, a cooperative effort between CDF, Napa City, Napa County, Resource Conservation District, and local FireSafe Councils.

1) Past Projects

A majority of past projects have been in the wildland-urban interface areas on the west aspect of the Napa County. There are two communities, Deer Park and Angwin, and many other clusters of homes in the wildland environment.

The Pacific Union College VMP (Rx North-049-LNU) was located in the wildland urban interface area just to the north and east of the town of Angwin. The project's objective was to reduce the flashy fuel accumulation near structures and other assets at risk while protecting timber and wildlife resources. The primary method to accomplish this objective was through manual and mechanical treatment using CDF Fire Crews from Konocti Conservation Camp. Fuels were removed manually and either chipped, piled and burned, or broadcast burned. Over one hundred acres were treated, including the Howell Mountain Road corridor.

St. Helena Hospital VMP (Rx North-051-LNU) was adjacent to the grounds of St. Helena Hospital, a steep hillside complex in the community of Deer Park. The objective of this project was to reduce the heavy brush fuel load that could contribute to a fast moving, high intensity wildfire that would endanger a major health care complex and the surrounding residential communities. Work was performed by CDF Fire Crews from Konocti Conservation Camp to prune trees, cut brush, and remove dead woody ground material. Removed fuels are chipped and spread onsite, or burned in small piles during the winter months. Eighty acres were treated.

Other recent VMPs include the Wildlake and Pickett on the slopes above the Napa Valley Floor.

The small neighborhood of Madrone Knolls which is located just off of and above Silverado Trail, has worked with CDF to establish a shaded fuelbreak using personnel from the Civilian Conservation Corps. The intent is to use periodic grazing with goats to maintain the shaded fuelbreak. Silverado Trail parallels Highway 29 on the east side of Napa Valley, and as such attracts motorists attempting to avoid traffic congestion on Highway 29. These motorists represent possible wildfire ignitions that would burn uphill into the Madrone Knolls area.

2) Present Projects

The most prominent present project is the use of goats to reduce fuel loading in the Angwin, Deer Park, and Madrone Knolls wildland-urban interface. Chief Mark Barclay secured a BLM grant of $48,000 to make the project possible. Besides the use of goats, chipping, hand limbing, piling, and burning will be used.

Angwin and Deer Park are participating in the Napa County FIREWISE chipping program. Refer to Figure 30.

3) Future Projects and Priority Rankings

Future project priorities include the continuation or extension of the use of goats for fuel reduction, Napa FIREWISE chipping program, and the use of CDF Fire Crews to maintain and extend the interface clearance.

Chief Barclay would also like to place emphasis on the reduction of fuels in Los Pasadas State Forest due to its' current condition and proximity to structures.

Photo 27: Napa FIREWISE Chipping Program

F. Battalion 1415 (Scott Kuhn)

Solano County, and the eastern edge of Napa County including Lake Berryessa is Battalion 1415. Lake Berryessa is a recreational destination and generates many medical related calls for service and the potential for large wildfires. Surrounding the lake, and along the roadways leading to the lake, are small rural subdivisions, such as Circle Oaks, and the Berryessa Estates, which increase the assets at risk.

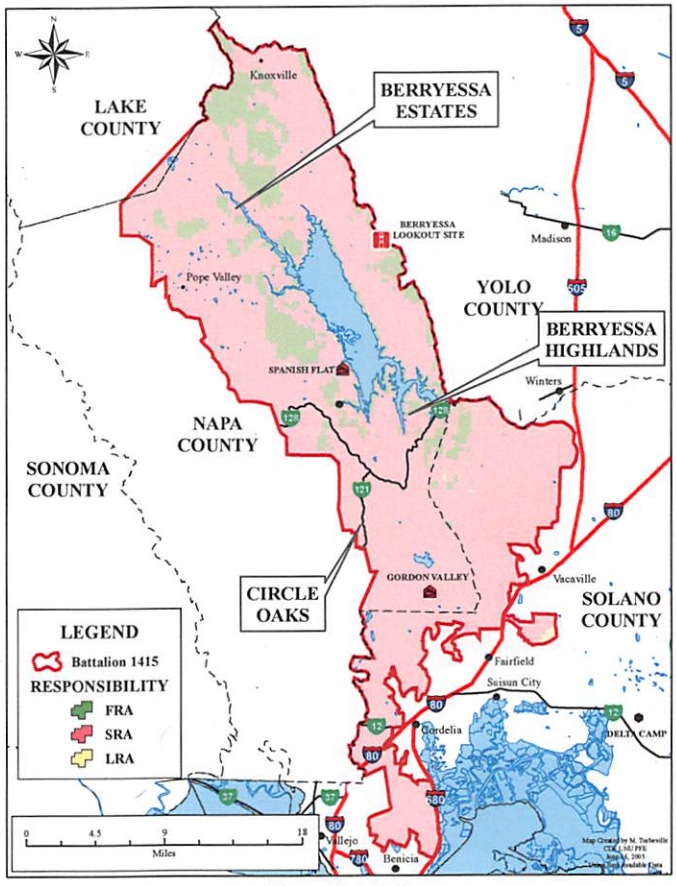


Figure 28: B1415

There are two CDF fire stations in Battalion 1415, Spanish Flat with two fire engines and a bulldozer near Lake Berryessa and a single engine station on Gordon Valley Road near the Napa/Solano county line. Last year's Rumsey Fire burned down Berryessa Lookout that was located on the top of Blue Ridge along the Napa/Yolo county line.

Battalion 1415 administers the volunteer fire companies of Pope Valley, Capell Valley, and Gordon Valley. There are no paid fire departments in this area of Napa County. The Solano County portion of the battalion is mostly covered by paid fire departments and CDF is rarely first to arrive on any fire in Solano County.

1) Past Projects

Past projects have been around two of the developed subdivisions. In the 338-lot Circle Oaks subdivision, a multi-year fuel modification project is being funded, in part, by the BLM through the Community-Based Wildfire Prevention Grants Program. Circle Oaks represents the largest concentration of people and house in Napa County. In 2002 they completed a Fire Safe and Fuel Management Plan.

The Circle Oaks subdivision is located along Highway 121 between the City of Napa and Lake Berryessa. The fuel modification aims at making it possible to contain vegetation fires that start within the subdivision to the subdivision, and to protect the subdivision from any encroaching wildfire. Shaded fuelbreaks were created along Napa County roadway easements. Over 2,500 tons of fuels have been removed from the perimeter greenbelt defensible space zone, and almost 300 tons of additional vegetation from vacant lots. An estimated 800 cubic yards of vegetation was removed from around structures following a LE-38 defensible space inspection program, and right-of-way clearance was accomplished along seven miles of road.

Berryessa Estates is a remote subdivision in the northeastern portion of Napa County consisting of 160 lots. Due to many factors including remote location causing long response times, one-way access, high-density flammable fuels with intermixed structures, this subdivision has been designated as an area of concern regarding wildfire. CDF personnel along with Pope Valley volunteers, and the Napa County Road Department worked with the Berryessa Estates Homeowners Association (BEHOA) to have members of the Association clear fuels around their homes to then be chipped. A total of fifty piles were chipped. The BEHOA has expressed interest in created a firesafe council.

Photo 28: Berryessa Estates. Photo courtesy of Napa FIREWISE.

2) Present Projects

Berryessa Estates and Berryessa Highlands are participating in the Napa FIREWISE chipper program.

Circle Oaks continues to use a private contractor for chipping.

3) Future Projects and Priority Rankings

Priority for projects will be placed on projects sponsored by the Napa FIREWISE program.

Photo 29: Napa FIREWISE Chipping Program. Photo courtesy of Napa FIREWISE.

G. Battalion 1416 (Dave Shew)

Battalion 1416 is a "combination" battalion in that it consists of both CDF staffed county owned structural fire engines and a truck, and CDF wildland orientated fire engines. Even though they are funded through different sources, the day-to-day operations are seamless. Three facilities are in the battalion. Yountville station, near the Yountville Veterans Home, house a structural fire engine and ladder truck, Napa station with a structural fire engine and a CDF fire engine, and Greenwood Ranch, near the Napa County airport, with a structural fire engine and a CDF fire engine.

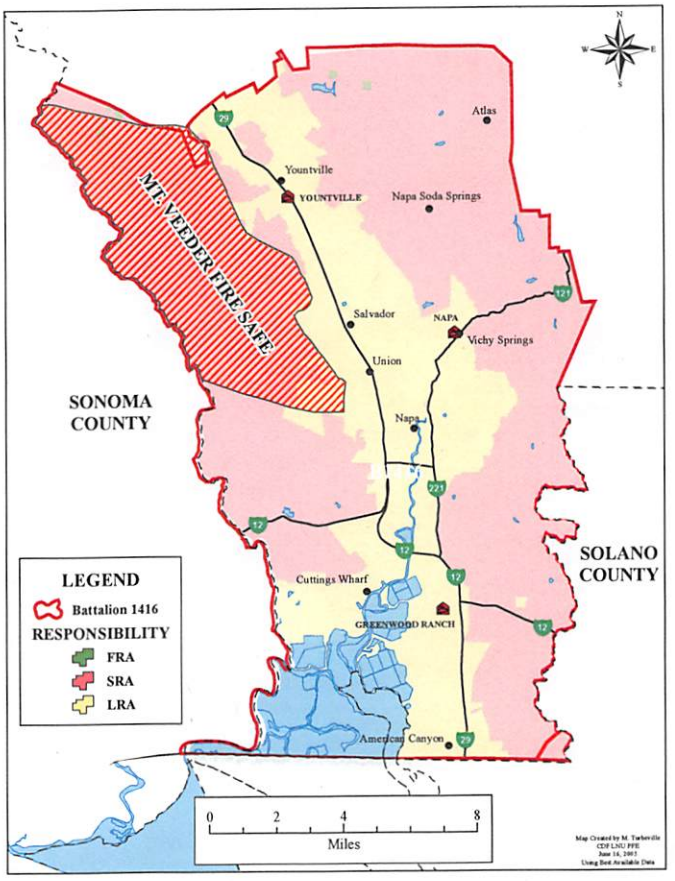


Figure 29: B1416

Dry Creek-Lokoya, Edgerly Island and Soda Canyon volunteer fire companies are assigned to Battalion 1416. Career fire departments within the Battalion are Napa City, American Canyon Fire Protection District, and Napa State Hospital.

MOUNT VEEDER FIRE SAFE COUNCIL

The Mt. Veeder Fire Safe Council is located in the battalion. It incorporates the same space as the Dry Creek-Lokoya volunteer fire company, or the mountainous terrain east of Yountville near the Napa-Sonoma county line. The volunteer fire company provides office space and supports the Council. The Council has received two grants, one for startup supplies such as office supplies and equipment, letterhead, mapping services, and to conduct community forums. The second was for a chipper program, which is described under past projects.

1) Past Projects

In 2003, following LE-38 defensible space inspections, a community chipper programs was completed using funds from a BLM grant. The inspections along with public education, strived at getting voluntary compliance with defensible space laws. Fifty-two piles were produced by local residents and chipped by a team consisting of CDF, Napa County Fire Department, Mt. Veeder Fire Safe Council, Napa County Road Department, and Civilian Conservation Corps personnel.

2) Present Projects

All present projects are being administered through the Napa FIREWISE program and the Mt. Veeder Fire Safe Council.

3) Future Projects and Priority Rankings

As with the present projects, future projects and their associated ranking are being administered through the Napa FIREWISE program and the Mt. Veeder Fire Safe Council.

H. Napa FIREWISE

All of the Napa County field battalions are incorporated into the Napa FIREWISE program. This program involves CDF, Cities of Napa, St. Helena, and Calistoga fire departments, Napa County, local FireSafe councils, and the resource conservation district to fully engage the Public of Napa County in wildfire awareness and mitigation measures. Additional information is available at their website (www.co.napa.ca.us/firewise).

The Napa FIREWISE Plan has been reviewed and approved by the County Board of Supervisors. It is composed of five main elements: Education, Built Infrastructure, Fuels/Vegetation, Firewise Land Use Planning, and Emergency Response Preparedness. It identifies through GIS the focused hazard areas and is aligned with the 2000 county disaster plan. The Interface Plan has a multi-year phase-in approach, with permanent change at the lowest levels (homeowner and local government) as its' cornerstone philosophy. It covers all aspects of the interface hazard prevention, response, and planning. The Napa County approach assumes multiple partners and technical training of all resource managers and land use policy makers in the county. It also makes use of the most advanced GIS systems currently available to local government.

Following is an outline of the five elements of the Program.

1. Firewise Education Program
   - a) Public Education Program
   - b) Technical/Professional Education Program
   - c) Interactive Internet Education Capability
   - d) Watershed/WICC Co-education Program

2. Firewise Built Infrastructure
   - a) Ignition-Resistant Construction
   - b) Enhanced Water Supplies (Built-in or Delivered)
   - c) Residential Sprinklers
   - d) FireSafe Roads and Driveways

3. Fuels/Vegetation Management
   - a) Defensible Space
   - b) Private Party Defensible Space Inspection Program
   - c) Insurance Industry Involvement
   - d) Designated Fuel Break Zones/Community Fuel Breaks
   - e) Watershed Management Plan with Fire Ecology Recognition
   - f) Timber Management Policies
   - g) Prescribed Burn and Smoke Management Program
   - h) Biomass Program

4. Firewise Land Use Planning
   a) GIS-based Hazard Analysis/FFIRE Program
   b) General Plan/Zoning Consideration for Wildfire
   c) CEQA Guidelines for Fire Impacts
   d) Project-specific Fire Protection Plans

5. Emergency Response Preparedness
   a) DMA 2000 Certified Disaster Plan and Exercises
   b) Equipment/Staffing Recommendations
   c) Emergency Response and Evacuation Plans
   d) CERT Program[11]

1) Present Projects

Through the assistance of a contracted public relations firm, a website, as referenced earlier, has been developed along with brochures, the necessary materials for public meetings including an electronic presentation, and numerous press releases have been distributed to the media.

This year numerous stakeholder meetings were held, a large-scale evacuation drill was held in the Montecito Heights area, the first defensible space inspector course was held, and a booth was set up for three days at the Napa-Solano Home and Garden Show.

2) Future Projects and Priority Rankings

The first priority is the public education about fire threat and what residents can do to mitigate it. Immediate future plans are for the direct mailing of 15,000 brochures to residents living in the urban-interface, stakeholder meetings, a defensible space inspector course, and additions to the website.

The second priority is to continue the established successful chipper program. The 2005 chipper program targeted seven high fire hazard communities around the county. Refer to Figure 30.

The third priority is to utilize GPS, GIS, and remote sensing to assist in public education and fire hazard analysis. In 2005, the program worked with a fire ecologist and GIS consultant to develop a model for assessing fire hazard severity zones using existing GIS data and aerial photographs. Work was also done in collaboration with Colorado Springs Fire Department's Firewise personnel to model their public internet map service for displaying the fire hazard severity of each parcel.

[11] From Napa FIREWISE's 2005 Western States Wildland Urban Interface Grant Application.

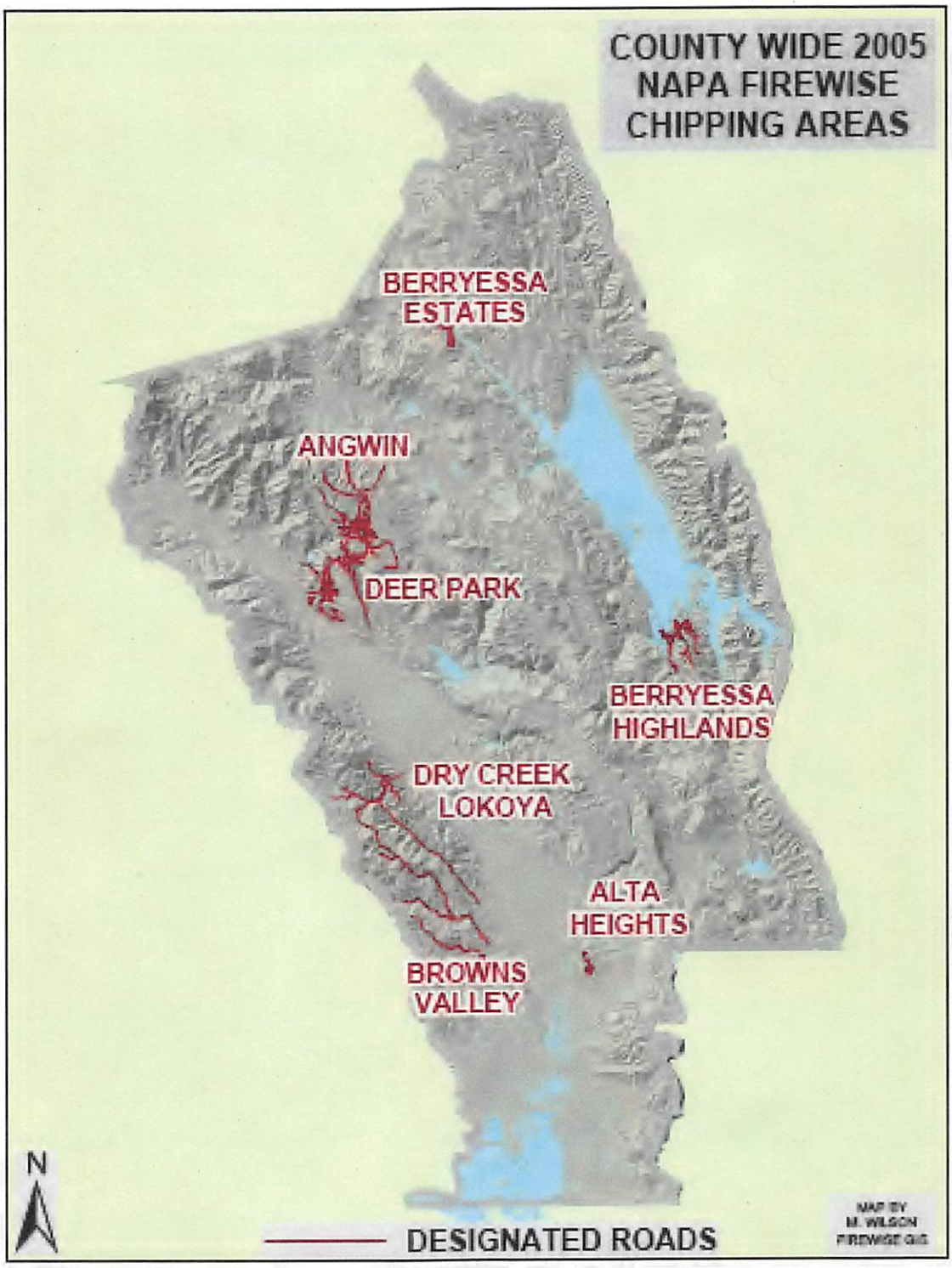


Figure 30: 2005 Napa FIREWISE Chipping Areas

I. Battalion 1417 (Bill Klebe)

Battalion 1417 is unique in the fact that much of the battalion is also the South Lake Fire Protection District (SLFPD). And the confines of the District are also a firesafe council, the South Lake County Fire Safe Council. Highway 29 is a major traffic corridor through the county and for commuter traffic to Sonoma and Napa counties.

CDF facilities in Battalion 1417 are a fire station with two fire engines and a bulldozer in Middletown, and a CDF helicopter at Boggs Mountain Helitack Base near Cobb. CDF also, through a cooperative contract with the SLFPD, staff two paramedic ambulances, one near Cobb and the other in the Hidden Valley Lake subdivision. The district operates two additional fire stations using volunteers.

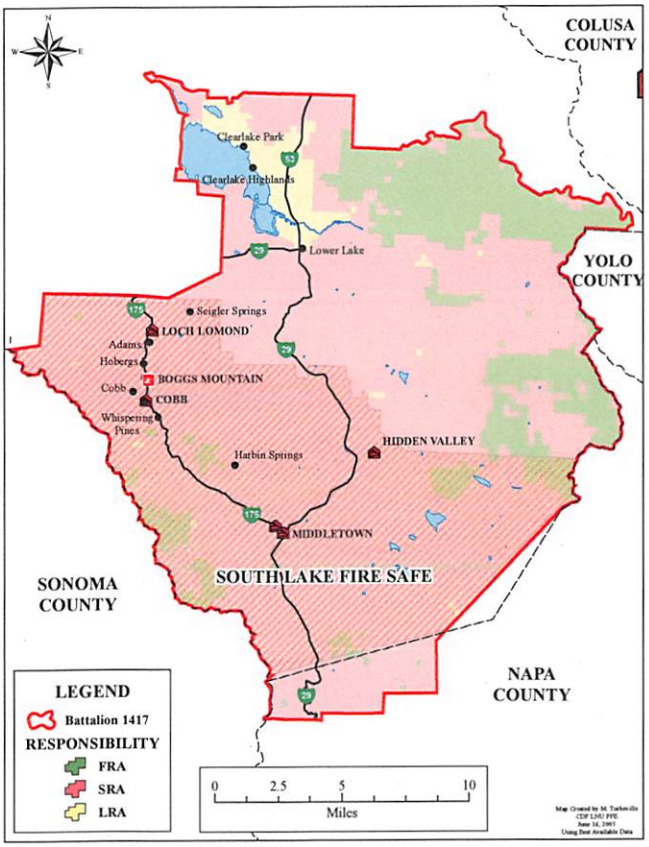


Figure 31: B1417

This South Lake County Fire Safe Council is very active. It covers an area of approximately 258 square miles. They have received funds through BLM several times over the past few years for various projects. The Council coordinates a chipping program, community meetings to inform and educate residents, run public service announcements on the local radio and cable channel, and post fire safety related signs throughout their "area."

Hidden Valley Lake is an approximately 3,000-parcel subdivision, along Highway 29 that has introduced a lot of structures into a fire prone environment. Hidden Valley Lake is a gated community that has incorporated Public Resources Code 4290 and 4291 defensible space laws into their homeowners' code of conduct and regulations. They also maintain a fuelbreak around the subdivision, as well as completing fuel reduction for the "common" areas of undeveloped land.

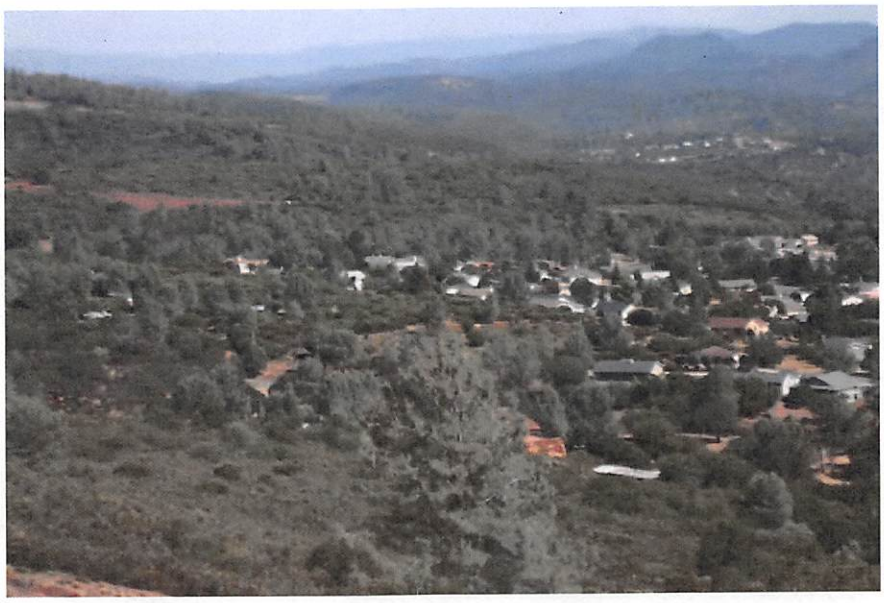


Photo 30: Southeastern Edge of Hidden Valley Lake Subdivision

1) Past Projects

Following is a list of completed past projects performed by the South Lake Fire Safe Council:

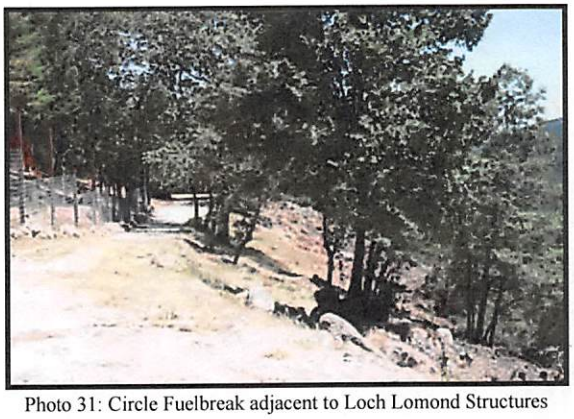


Photo 31: Circle Fuelbreak adjacent to Loch Lomond Structures

- Chipping on over 150 different sites
- Shaded fuelbreak along approximately 3 miles of Bottle Rock Road
- Completed Sycamore Fuelbreak (0.6 miles)
- Completed Circle Fuelbreak (0.7 miles)
- Evacuation Plan
- Community meetings
- Public Service Announcements on radio, cable, and in newspaper focusing on Fire Safe

2) Present Projects

The South Lake Fire Safe Council is currently working on the following projects:

- Chipping Program
- Prather Fuel Break (1.6 miles of which 20% has been completed)
- 2006 Fire Safe calendar
- Securing Title III funds (approximately $50,000)
- Increase publicity using local media
- Community meetings
- Hidden Valley fuel reduction program

3) Future Projects and Priority Rankings

The South Lake Fire Safe Council's future projects include:

- Additional fire breaks in critical areas as identified by CDF personnel
- Chili cook-off fundraiser
- Redistribute evacuation plan
- LE-38 defensible space inspections in Loch Lomond area

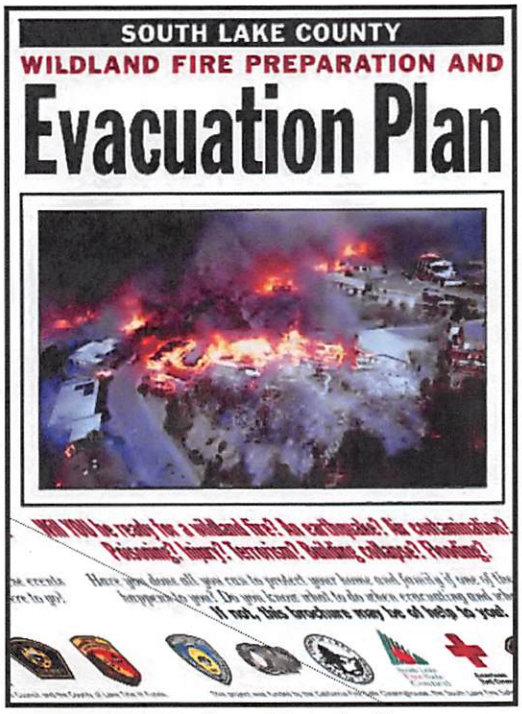


Photo 32: Cover of Evacuation Plan

Photo 31: Example of Roadside Sign

J. Battalion 1418 (Jamie Crabtree)

Northern Lake County except for lands in the Mendocino National Forest belong to Battalion 1418. Because of the proximity to the National forest, Battalion Chief Crabtree works frequently with them, and their resources are incorporated into CDF initial attack dispatches. Battalion 1418 fire stations are located along Highway 175, Kelsey-Cobb, and along Highway 20, Clear Lake Oaks. Kelsey-Cobb is staffed with two fire engines, and Clear Lake Oaks is staffed with two engines and a bulldozer.

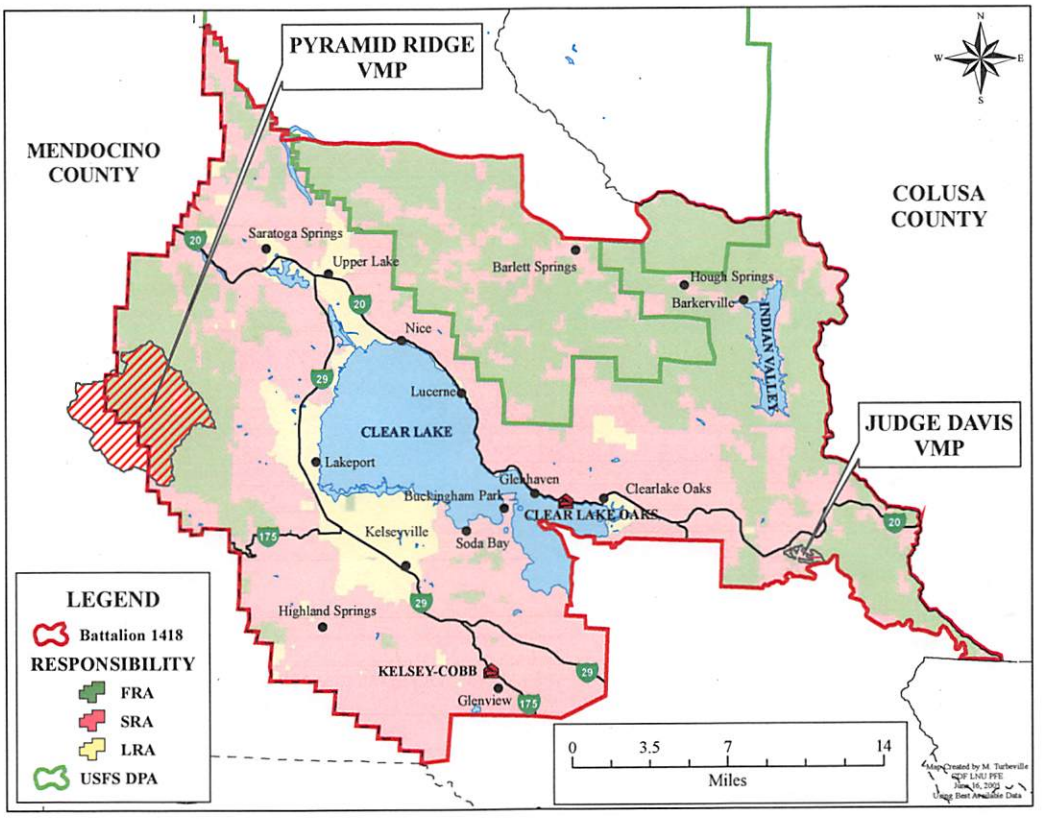


Figure 32: B1418

1) Past Projects

Battalion 1418 projects focus mainly on prescribed burning. Recent past projects include Cow Mountain and Judge Davis Canyon.

The Cow Mountain (Rx North-047-LNU) project burned brush to lessen the fuel loading, protect assets at risk, improve wildlife habitat, and increase water yield. The project was located in mountainous terrain near the Lake/Mendocino County Line. Fifty acres were burned in November of 2002.

The Judge Davis Canyon (Rx North-052-LNU) project was located in Lake County ten miles east of Clearlake in the Rocky Creek-Cache Creek Wilderness Study Area, which is managed by the BLM. Vegetation is primarily chemise and mixed chaparral and has historically been the site of periodic wildfires. Project objectives were to reduce fuel loading, improve wildlife habitat, and increase water yield.

2) Present Projects

A possible project is in the planning stages in the Cow Mountain Area for prescribed burning called the Pyramid Ridge VMP.

3) Future Projects and Priority Rankings

None are proposed at the time of publication.

L. Battalion 1419 (Jim Wright)

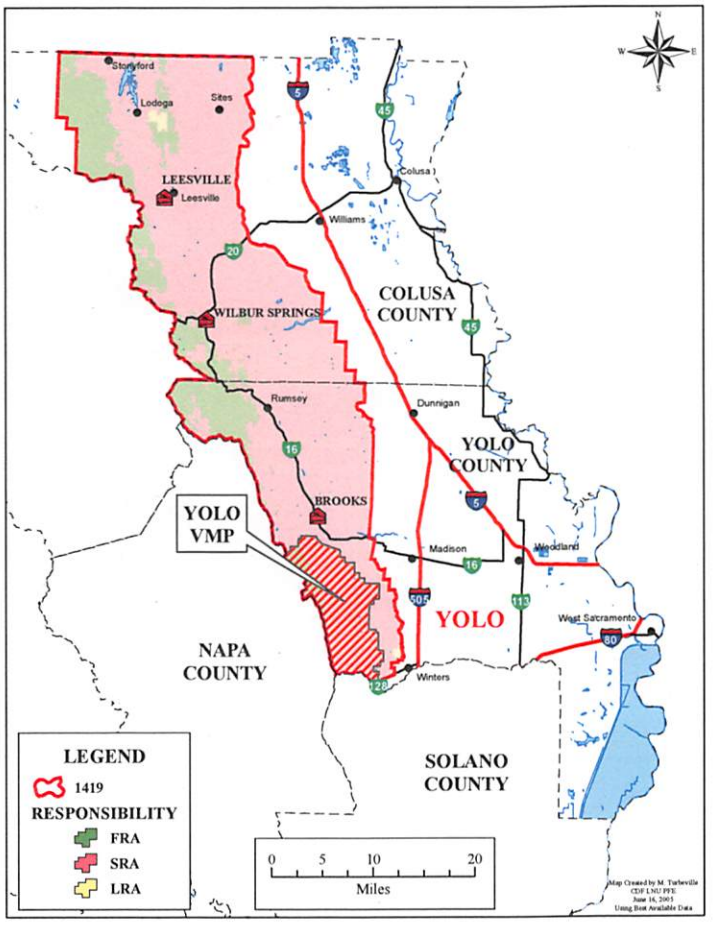


Figure 33: B1419

Battalion 1419 is the eastern edge of LNU, running the length of Colusa and Yolo Counties, with three single engine fire stations located near Leesville, Wilbur Springs, and Brooks. The battalion is very rural, with many large landowners.

Highway 16, which runs from Highway 20 to Interstate 505, has had an above average number of fire ignitions in the area referred to as Rumsey Canyon. The largest CDF fire in the state last year started in Rumsey Canyon and burned south to Lake Berryessa being pushed by a North wind.

1) Past Projects

CDF has been able to take advantage of the rural setting and large landowners to complete many prescribed burns over the years.

2) Present Projects

Battalion Chief Jim Wright, and the previous battalion chief, Bill Klebe, have been very proactive in working with landowners and BLM to complete prescribed burns for a variety of purposes.

The Yolo VMP (Rx North-057-LNU) was developed in conjunction with the National Audubon Society of California, Yolo County Resource Conservation District, and the BLM. The goal is to, over a three-year period starting in 2003, burn brush in the fall and winter along with the spring burning of non-native grassland species. 240 acres of non-native grasslands were successfully burned over three days in June of 2003, and 261 acres of brush were treated during the 2005 winter period.

Photo 32: Yolo VMP

Other small projects, such as the Payne Ranch prescribed burn in June of 2005 have been conducted to eradicate undesirable exotic weed species. And CDF's Northern Region firing class is held near Williams each year. Besides offering training for CDF personnel it creates a firebreak between the SRA mountains and the LRA valley floor.

3) Future Projects and Priority Rankings

Future projects will continue to include working with landowners and the BLM to conduct prescribed burning for desired resource management objectives.

IX. INSTITUTIONAL ISSUES

Assuming that community groups understand the importance of fuel reduction, what prevents the work from getting done? There are a variety of reasons.

At the Unit level, an assistant chief and fire captain are responsible for pre-fire projects. It is difficult to maintain contact and support the various FireSafe councils and other community groups. This issue has been compounded as the assistant chief's position has been left vacant since May 1st, 2005 and the fire captain is on a temporary assignment, being regularly assigned to a fire station. In order to complete more "on-the-ground" pre-fire projects, more personnel need to be assigned to work in the six county area. In other units, a similar level of staffing is afforded to one or two counties.

Another "personnel" issue is the availability of CDF fire crews to complete projects. The locations of conservation camps, associated travel time, and other projects create competition and makes it impractical for the use of fire crews in some areas of the Unit. In place of CDF crews, CCC crews or private contractors are used. There also appears to be an increased demand for crews during the summer months for wildfires assignments, which make them less available.

Many projects are completed that meet the intent of LNU's Fire Plan but don't involve CDF personnel. An example is roadway clearing that is done by county or State road departments. In essence, these departments are creating a similar desired condition along roadways that FireSafe and and other community groups are submitting grants for. Other community groups, or even large landowners, are creating their own fuelbreaks or conducting their own control burning without involving CDF. Many of the departments or personnel completing these projects are unaware of CDF's potential involvement and/or feel that they can complete the projects without CDF's involvement. Rightfully so, many of the projects, such as roadway clearing, do not need to engage CDF pre-fire personnel in the process.

Photo 33: Example of Roadway Clearing

The practice of control burning has, for the most part, become extinct in parts of LNU. Within the boundaries of LNU are six air quality districts. Each has an established approval process for control burning. Additionally, members of the Public object to the production of smoke, either for visual disturbance or health conditions. The other "big" issue is the concern for a control burn to escape. These issues can only be overcome through better education.

X. APPENDIX A

Prefire/Wildfire Interaction Report

FIRE NAME: The Geysers INCIDENT #: CA-LNU 006644

DATE: September 3-8, 2004

UNIT: Sonoma-Lake Napa (LNU)

INCIDENT COMMANDER: Streblow

FIRE ACREAGE: 12,525 acres

SUPPRESSION COST: $_____

DAMAGE TO ASSETS AT RISK: $_____

PREFIRE TREATMENT: Manual fuelbreaks constructed by Konocti Conservation Camp crews.

BENEFITS OF TREATMENTS TO SUPRESSION EFFORT: Reduced direct flame and heat impingement on two 110-megawatt power plants and allowed for confident and safe deployment of firefighters ahead of advancing wildfire (see photos).

REDUCTION IN SUPPRESSION EFFORT: N/A

REDUCTION IN SUPPRESSION COSTS: N/A

ESTIMATED VALUE OF ASSETS SAVED: $400 million.

SUPPORTING DOCUMENTATION (PHOTOS, MAPS ETC.):

A guiding principle of LNU's Fire Management Plan is to use Konocti and Delta Conservation Camps to implement fire safe projects on public lands that have been identified in the Plan as priorities. These projects are executed as routine work projects meeting the Legislature's Policy Declaration of using the camps "to perform public conservation projects including...fire prevention and control, and forest and watershed management." During the Geysers Fire in September 2004, one such project was instrumental in mitigating the costs and losses due to a major wildfire that threatened two of the primary assets at risk identified in the Unit's Fire Management Plan.

During the previous winter of 2003-2004, LNU's Prefire Division Chief Dana Cole and Battalion Chief Kim Thompson worked with representatives of the geothermal power industry in the Geysers Known Geothermal Resources Area (KGRA) to develop an assets at risk analysis and recommendations for protection of 22 power generating plants and associated support buildings. Located on an active fault of the Clear Lake Volcanic Area, the Geysers KGRA constitutes the most productive geothermal field in the world, generating up to 2,000 megawatts of electrical capacity, enough to supply the electrical power needs of more than 1 million Californians. The generating plants themselves are valued at $200 million each, and are located across 30,000 acres of one of the most wildfire-prone regions of the Unit. Specific recommendations were developed for each facility for the purpose of improving asset survivability and firefighter safety. A private contractor was hired to implement vegetation management recommendations on the 20 privately owned power plants.

The two remaining plants are owned and operated by a public agency, the Northern California Power Agency (NCPA), a California Joint Action Agency. NCPA membership is open to municipalities, rural electric cooperatives, irrigation districts and other publicly owned entities interested in the purchase, aggregation, scheduling and management of electrical energy. A total of 12 NCPA members own shares of the generation facilities. These include the California cities of Healdsburg, Redding, Ukiah, Gridley, Lompoc, Palo Alto, Biggs, and Roseville, all of which receive a portion of their electricity from the 220 megawatts generated at the two NCPA plants in the Geysers KGRA.

The NCPA plants are located on graded pads at the top of steep, brush-covered slopes. During the winter of 2003-2004, NCPA contracted with Konocti Conservation Camp to construct firebreaks around the plants. When a major wildfire burned this area the following September, the defensible space afforded by these fuelbreaks was credited with protecting the facilities. Direct flame and heat impingement was reduced due to the vegetation clearance, and firefighters were able to deploy safely and act.

Firefighters defend NCPA Plant #1, September 4, 2004

NCPA Plants # 1 (left) and #2 (right) following the Geysers Fire, September 2004.